RAILROAD GAZETTE

FRIDAY, SEPTEMBER 14.

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Contributions.

Property in Inventions.

NEW YORK, Sept. 4, 1888.

TO THE EDITOR OF THE RAILROAD GAZETTE:

As your answer to the questions asked you (*Railroad Gazette*, Aug. 31, p. 567), relating to the rights of inventors and subordinates does not fully cover the ground, will you have the kindness to answer the following questions:

First: Providing a subordinate shall, while in the employ of an inventor perfecting details of an invention, make some improvements upon the same, and without consultation with his employer apply for and obtain a patent for his improvement, what remedy has his employer against such a patent, and what is the proper course for him to pursue?

Second: Does the invention covered by such a patent rightly belong to his employer, or only the use of it in his business?

Your reply through the columns of your paper will greatly oblige, E.

[The law provides that a patent shall be issued to the first inventor; consequently, if the employer considers himself to be the first inventor, he should make application for a patent thereon, which application should be so drawn as to embody the subject-matter of the patent obtained by his employé. When his application is considered by the Patent Office, he will probably be referred to the patent of his employé. He can then file an oath setting forth that he made the invention prior to the date of the patent of his employé, after which the Patent Office will declare an interference and the respective parties will be required to prove their case before the Patent Office. The burden of proof will rest upon the employer, as his application was last filed. If, in the interference proceedings, it can be shown that the employé received his information from the employer, or by an act of the employer was enabled to acquire information which led to the invention, and if the employer can show that such an invention was in his mind, contemplated or wholly or partially worked out, then the employer will be declared to be the first inventor. The courts look with suspicion upon the claim of an employé to independent invention while pursuing a course of experiment at the expense of an employer. This brings us to the second query: "Does the invention covered by such a patent rightly belong to his employer, or only the use of it in his business?" If the patent be granted to the employé without interference proceedings, then the employer cannot obtain it except by purchase or agreement. The employer, however, has the right to use the device constructed at his works for the lifetime of that device, which will, of course, include any repairs thereon. He cannot, however, duplicate the device or license others to use it or sell it.—EDITOR RAILROAD GAZETTE.]

Deflectors in Ordinary Smoke-boxes.

PITTSBURGH, Pa., Sept. 10, 1888.

TO THE EDITOR OF THE RAILROAD GAZETTE:

A discussion of the subject matter of the article on "Some Functions of the Brick Arch and Extension Smoke-box" in the *Railroad Gazette* of Sept. 7, 1888, I understand to be admissible under the terms of the standing notice at the head of your editorial columns, and if such be the case, I desire to present a preliminary question of fact, the determination of which materially affects, so far as the extended smoke-box is concerned, the correctness of the deductions of the article referred to.

The deflector plate is therein stated, in terms, to be "possible only in the extension smoke-box," and is again, by implication, stated to be necessarily related to the latter by the language, "The deflector plate used in the extension smoke-box, however, gives a much better distribution of the draft," etc

Without now discussing the theoretical question of the independence of the deflector plate, both in structure and function, relatively to the extension of the smoke-box, I submit that, as a matter of fact, the deflector plate is not only *possible* in a smoke-box of normal dimensions, but is in actual and successful use in smoke-boxes of such character.

The record evidence to this effect will be found in the repliesof Messrs. W. J. Robertson (Central Vermont R. R.) and Wm. Wilson (Chicago & Alton R. R.) to the circular of inquiry of the Committee on Extension Fronts and Brick and other Fire-box Arches, which replies are embodied in the Report of the Proceedings of the Twenty-first Annual Convention of the American Railway Master Mechanics' Association.

The statements of Mr. C. E. Smart, Michigan Central R. R. (20th Report M. M. Ass'n, p. 30) are substantially to the same effect, as the smoke-box extension of the engine to which he refers is only 8 in. in length. I have also personal knowledge of the successful use of the deflector plate, with very short extensions, on the Camden & Atlantic R. R., and believe it to be used in a number of engines, with *ordinary* smoke-boxes and straight stacks, on another road, but have not had time to ascertain from the machinery department whether such is the case. J. SNOWDEN BELL.

[Most of our readers will readily see that a deflector is physically possible in an ordinary smoke-box, but the important question is whether it is possible to use a deflector with advantage in the narrow confines of an ordinary smoke-box. The Master Mechanics' Report for 1888 contains four cases bearing on this point, but hardly bearing out Mr. Bell's statement.

Case A.—1. Smoke-box, 40 in. long for a 50-in. shell. 2. Evaporation, 2½ to 5½ lbs. of water per pound of coal. 3. Cost of coal, 10½ cents per locomotive mile.

Case B.—An ordinary smoke-box is fitted with a deflector plate and an opening in the bottom of the front or leading to a hopper placed over the front truck axle. Pipes lead from this spark receptacle and terminate in a single nozzle under the ash pan, the sparks being ejected by a jet of steam or water and thrown on the ties. The drawings do not show clearly whether water or steam is used. The master mechanic states that: "It is cheap, simple and effective, preventing any danger from fire, and is an improvement to the steaming qualities of the engine over either the extension or the ordinary smoke-box."

Case C.—In reply to the question, "Have you had any experience with a device in the ordinary box that would accomplish the same end as that claimed for the extension front? If so, please state results obtained, * * *" the master mechanic states: "Yes, had experience; was obliged to open front door every trip for the purpose of cleaning the smoke-box of cinders. The engine also sparked very badly, and the results generally were so poor we had to abandon it. The construction was deflector plate, netting, high nozzle and straight shot stack, arranged in ordinary smoke arches as in extension."

Case D.—A master mechanic reports that "he has experimented with a device for using a straight stack on short smoke-boxes with netting arrester and deflector plates, but finds it not practical."

It would appear therefore that in one case quoted by Mr. Bell as showing the successful use of the deflector in an ordinary smoke-box: 1, the smoke-box was considerably longer than an ordinary smoke-box; and 2, the results as regards evaporation were remarkably poor. As regards the other case quoted, the apparatus simply ejects sparks from the smoke-box instead of preventing their formation in the fire-box.

The other cases, not quoted by Mr. Bell, gave such bad results that they had to be abandoned.—EDITOR RAILROAD GAZETTE.]

Speed on Curves.

NEW YORK, Sept. 7, 1888.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I send you herewith a summary of the answers received by me in response to an inquiry as to what speed has been found practicable on curves of over 10°, in the experience of the engineers addressed. The inquiry was sent to the engineers of all the standard gauge roads in this country and in Mexico likely to make high speed over sharp curves. Answers were received from nearly all of them, and a very general interest shown in the subject.

Although few roads report high speeds on such curves, the evidence is rather in favor of their practicability, for the one road reporting speeds over 30 miles per hour on curves of over 10°, states that such speeds are frequently attained, while the other roads do not appear to have tried these speeds. None report any unfavorable experience with high speeds which has led to their reduction.

My impression is that the main difficulty in operating sharp curves at almost any speed lies in the entrance of the curve, but I cannot say that the answers to my inquiries lend much support to this view. Perhaps some of your readers may be able to throw further light on the subject.

The limit set for super-elevation is noticeable. The practice is becoming quite general of elevating at a certain rate per degree, say one-half inch, up to a certain amount and then keeping the elevation uniform for all sharper curvatures.

The summary is as follows:

One trunk line reports it possible to run at 30 or even 40 miles per hour around 10° curves, but that comfortable travel is not practicable with such curves and speeds. This correspondent would not consider a trunk line railroad suitable for first-class traffic and fast speed with more than 3° curvature.

Another trunk line reports traffic at 30 miles over 14° curves without easement. The engineer believes spirals on the ends conduce not only to greater safe speed, but also to steadier running.

Another important line reports speed reduced from 30 miles on 14° curve; and steam shut off on entering 10° and 8° curves until the whole train is on the curve.

Another very important system is scheduled to make over 30 miles over 14° 20′ curves without easement, and the engineer believes 50 miles is frequently made. He believes good surface and uniform curve and elevation more important than easement of ends. When some mode is found to secure this, it will be time enough to take up the much more difficult task of preserving the proper condition of the constantly varying curve and elevation on the easement portion.

A heavy coal road reports 16° curves run at 20 miles, and 30 miles over 14° curves, without easement in either case.

The engineer of a prominent Rocky Mountain road reports 17° curve run at 25 miles per hour. The curve was originally guard railed and still remains so. It is not known whether or not the guard rail is necessary. Curves of 12° and 15° without easement are run at 20 to 25 miles per hour. Experience shows 3 in. to be the maximum super-elevation desirable. This road has run 50 miles per hour over 10° curves. New lines are built with easement, but do difference is appreciable.

Another transcontinental line reports 16° curves under conditions precluding fast running. Curves not eased. Trains probably run occasionally 20 miles per hour. New lines are being built with easement.

Another great mountain system reports 30 miles per hour over 10° curves. Fourteen-degree and 15° curves have guard rails and 10-mile slow boards. They are elevated only 2 in. All of these have taper curves on the ends. The engineer considers there is more danger of climbing outer rail with elevation over 2 in. than under that.

The Callao, Lima & Oroya Railroad, in Peru, is built with 15° curves without easement. Speed probably never exceeded 20 miles. No accidents ever had due to sharp curves.

Other standard gauge roads reporting use much lower speed, not being driven to high ones by any sharp competition. W. HOWARD WHITE.

The Dutch Method with Swamp Foundations.

NEW YORK, Sept. 10, 1888.

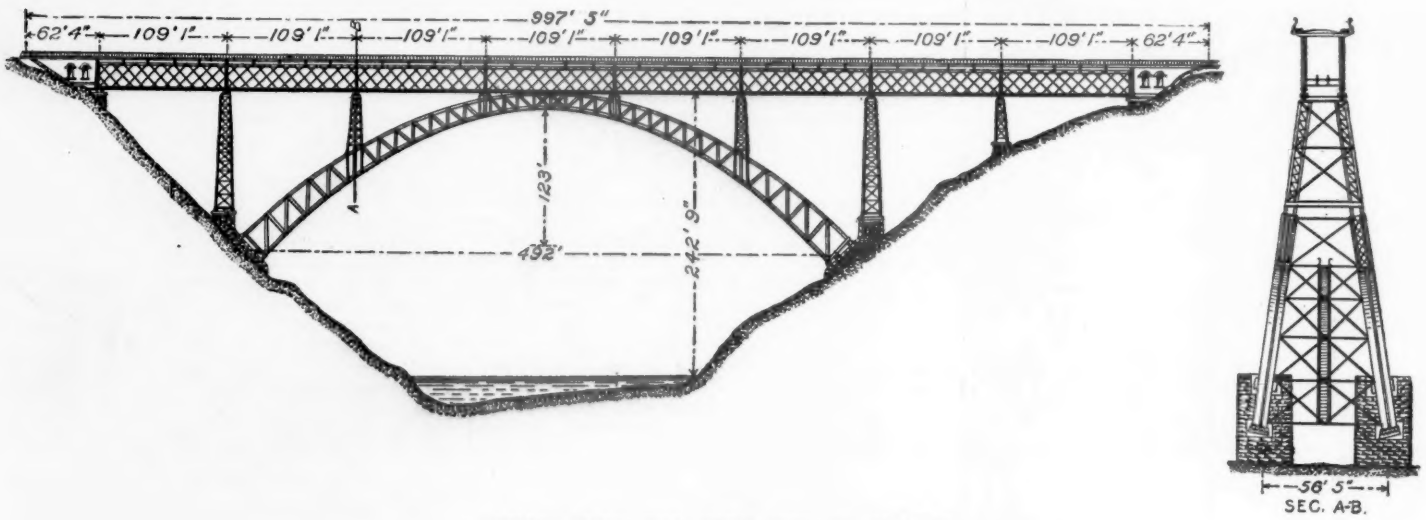
TO THE EDITOR OF THE RAILROAD GAZETTE:

In connection with Mr. McElroy's last communication, "Swamp Embankment Stability," the readers of the *Gazette* may be interested in a description of the practice of the engineers of Holland in the construction of railroad and other road embankments over the morasses of that country. These banks are founded on a "matrass," which is made in the place in which it is to be used, the surface of the swamp, and is continuous over the whole length of the swamp. These matrasses, unlike those used in this country, are commenced by laying down fascines of willow parallel to the long axis of the matrass, instead of poles. A stout stake is driven through the fascine from the under side, with a fork on its lower end so that it cannot be pulled through the fascine, at the same time a stout rope is passed around the fascine so that it lies in the bight of the rope and the two ends are fastened to the top of the stake. The brush is then piled on the rows of fascines, carefully breaking joints, and all of the willow in these matrasses is placed transversely to the fascines, until the matrass is thick enough, when other fascines are made on top of and parallel to the first, embracing the top of the stakes. The ends of one of the ropes tied to the tops of the stakes are then tied over a long lever, one end of which rests on a bearing piece placed on the top fascine, and the other end is raised to compress the matrass. When that is done sufficiently, a hole is bored through the stake and a cross piece driven in to keep the matrass compressed, and the rope is drawn out for use in another place.

These matrasses, which may be from two to four feet thick, depending both on the depth of the swamp and the height of the bank, are thought to be more flexible than those made on the American method by "sewing" poles or scantlings together for binders, instead of fascines, with telegraph or fence wire, and, it may be added, are more expensive, considering the cost of our labor.

When the matrass is completed, three lines of stakes are driven in it, with care as to perpendicularity and alignment, one row on each side and one through the centre, and the matrass is so loaded with the bank that it immediately assumes, and retains throughout its construction, a profile concave towards the marsh beneath it. The amount of this curvature is readily determined by the inclination of the two outer rows of stakes, which remain normal to the surface of the matrass, as the earth filling is put on in layers. The centre row should, of course, remain perpendicular and in line; this can be secured by loading one side or the other of the bank.

This arrangement in effect floats the bank, and excepting the "awkward elasticity" produced, its adoption as an en



BRIDGE OVER THE RIVER ADDA AT PADERNO.

gineering expedient should depend on the relation its cost bears to other methods. May it not be doubted if a limited amount of elasticity, so it is not great enough to interfere with the rail joints or to keep the locomotive pulling up hill, would be objectionable?

Floating banks in this country has not in general been successfully performed; this, perhaps, greatly because it is not often decided on until the bank has broken through the crust of the swamp, when the "practical man" comes forward, and with a perfunctory layer of untrimmed trees or other like inefficient appliance, tries to hold up the bank, and the failure of this ill-conceived measure is cited against efforts to prevent such accidents.

The surging ditch, mention of which it is pleasant to see for the first time in print, is often efficacious, but when a high bank of drift clay is dumped off a trestle during the snows of winter, its toe is apt to surge past any ditch the writer has seen. N.

Bridge over the Adda near Paderno.

The cut given in this number shows another bridge of the type made prominent by Mr. Eiffel's Douro bridge at Oporto. The subject of the illustration connects the line from Bergamo to Lecco, in Italy, with the Gotthard road.

It was selected by the Italian government out of numerous projects handed in, and is to be built by the iron works of Savigliano, in Piedmont, from the designs of Mr. J. Röthlisberger.

The contract called for its completion, including the masonry, within 18 months, for 1,850,000 francs (about $370,000).

The main arch has a span of 492 ft. between centres of bearings and a rise of 123 ft. The lattice truss spans are 109 ft. each and the total length 997 ft. As is indicated on the section the arch ribs are two in number and inclined to each other at a considerable angle. They carry first a single track railroad, and over this a wagon way 16.4 ft. wide and footways 1 metre, or 3.28 ft., wide, on each side of the wagon way.

The bridge is designed, according to the "Journal of the Austrian Engineer and Architects' Society," from which these particulars are drawn, for a load of 1,042 lbs. per sq. ft. of railroad and 757 lbs. per sq. ft. of highway! It would seem, however, that figures given, instead of being stated "per square metre," should have been "per running metre," which would make the test loads 3,420 lbs. per lin. ft. of railroad, and 2,616 lbs. per lin. ft., or 114 lbs. per sq. ft. of highway.

Wind pressures of 51 lbs. per sq. ft. for the bridge without load, and 30 lbs. per sq. ft. when loaded, were allowed in the calculations.

The lower chord of the truss is to stand 242 ft. above the water in the stream.

Twin Hopper 60,000-Lb. Gondola Car.—Lehigh Valley Railroad.

The accompanying illustrations represent a twin hopper bottom gondola car of 60,000 lbs. capacity constructed at the Packerton shops of the Lehigh Valley from the designs of Mr. John S. Lentz, Master Car-Builder.

The car is primarily designed for carrying coal, but it can also be used for conveying lumber stowed in two lengths of 16 ft. each. The cubic capacity of the car is 910 cubic feet, the load being level with the top of the sides of the car.

The mode in which the car is constructed and the size and arrangement of the parts employed are very clearly shown in the engravings. It will be seen that the thrust and pull of the drawgear is mainly taken by two yellow pine centre floor timbers, each 5 in. by 8 in., running the whole length of the car between the end sills. These are bolted to four short centre sills, 3⅜ in. by 10¼ in., to which in turn the draft timbers are secured. The dead blocks are very large and come low down in order to buff with the numerous old four-wheeled coal cars or "Jimmies" still running on the Lehigh Valley. The lower part of the dead block is braced back to the iron body bolster by a slightly inclined oak brace, 4½ in. by 8 in., one to each dead block.

The hoppers are supported partly by iron braces bolted and lipped on the side sills and passed underneath the hopper, while the centre of the hopper, where the braces would give an inefficient support, is upheld by ¾-in. bolts passing through the brace and resting on cant washers on the centre sills.

The side-stakes nearest the centre of the car are trussed by inclined strap-bolts, which take the top bolt of the hopper bottom brace. The weight of the coal in the hopper is thus utilized to stay the sides of the car against bulging.

Our engravings have been prepared from very detailed and remarkably well executed working drawings, and, though on a reduced scale, the details in the engravings are sufficiently clear to show with what care and skill the car has been designed.

The dimensions of the lumber used are given below:

LIST OF TIMBER.

No. of pieces.	Where used.	Kinds of lumber.	Finished sizes.	Rough sizes.	Feet of board measure in rough.
			in. in. ft. in.	in. in. ft. in.	ft. in.
2	Side sills	Yellow pine	4½ × 12 × 33 10 B. S.	4¾ × 12¼ × 34 3	332 1
2	Centre floor timbers	" "	5 × 8 × 33 10 B. S.	5¼ × 8¼ × 34 3	247 2
6	Side plank	" "	3 × 12⅜ × 33 6	3¼ × 12¾ × 33 8	697 6
6	End "	" "	3 × 12⅜ × 7 7	¼ × 12¾ × 7 8	158 6
2	Side "	Oak	1¾ × 6 × 7 2	2 × 6¼ × 7 3	15 1
4	" "	"	1¾ × 6 × 12 9	2 × 6¼ × 12 10	53 1
2	Rib "	"	1¾ × 10 × 9 4	1 × 10¼ × 9 6	32 5
1	" "	"	1¾ × 10 × 19 7½	2 × 10¼ × 19 9	33 8
1	Centre cross sill	"	4 × 14⅜ × 7 7	4¼ × 15 × 7 9	41 2
1	" " "	"	5 × 8½ × 8 1	5¼ × 8¾ × 8 3	31 6
4	Floor strips	"	2 × 2¼ × 6 4	2⅛ × 2¾ × 6 4	12 0
2	End sills	"	9 × 10 × 8 4	9¼ × 10¼ × 8 6	134 3
2	" planks	"	1¾ × 15¼ × 8 4	2 × 15⅛ × 8 6	43 11
4	Dead block braces	"	4½ × 8 × 5 7	4¾ × 8¼ × 5 9	75 1
4	Centre sills	"	3⅜ × 10¼ × 8 0 B. S.	3⅝ × 10½ × 8 3	104 8
4	Intermediate sills	"	3⅛ × 10¼ × 7 3½ B. S.	3¾ × 10½ × 7 9	101 8
4	Bottom sills	"	4 × 6 × 2 10⅝	4¼ × 6¼ × 3 0	26 7
2	Floor sills	"	2¼ × 7¾ × 7 7	2⅜ × 8 × 7 9	25 10
4	Dead block brace blocks	"	3 × 10 × 0 8	3¼ × 10¼ × 0 9	8 6
4	" " " "	"	6½ × 10 × 1 6	6¾ × 10¼ × 1 7	36 5
12	Side stakes	"	3 × 3⅜ × 4 0¾	3¼ × 3⅝ × 4 3	50 0
4	" "	"	3 × 4 × 4 0¾	3¼ × 4¼ × 4 3	19 6
4	Gate plank	"	2 × 7¾ × 5 1⅜	2¼ × 8 × 5 3	31 6
2	Rib blocks	"	4 × 8 × 1 4¾	4¼ × 8¼ × 1 6	8 9
4	Draw timbers	"	4 × 8¼ × 7 3¼	4¼ × 8½ × 7 6	90 3
4	Brake beams	Hickory	3¾ × 6½ × 5 6	4 × 6½ × 5 8	46 5
2	End floors (net)	Yellow pine	1¾ × 7′ 0″ × 7 7	1¾ × 7′ 0″ × 7 7	185 9
2	Floor blocks	" "	2¼ × 4 × 0 10	2¼ × 4 × 0 10	1 2
2	Floor plank	Oak	2 × 2′ 8″ × 7 4	2¼ × 2′ 8″ × 7 4	87 11
2	" "	"	2 × 5′ 1″ × 7 4	2¼ × 5′ 1″ × 7 4	167 8
	Total				2,000 0

Heath's Patent Self-timing Speed Indicator.

The accompanying illustration shows a self-timing speed indicator. The cut is the full size of the instrument.

The inventor's idea was to attain the perfection of a speed indicator which would be self-timing, self-registering and adapted to the highest as well as the lowest velocities.

The transmitting device consists of the detachable point shown at the left of the cut. This point, which is lance-shaped at one end, is provided with a socket at the opposite end.

Two strong pinions running together and each having a projecting shank fix the point socket so that a shaft running in each direction may be timed by attaching the point to the corresponding pinion.

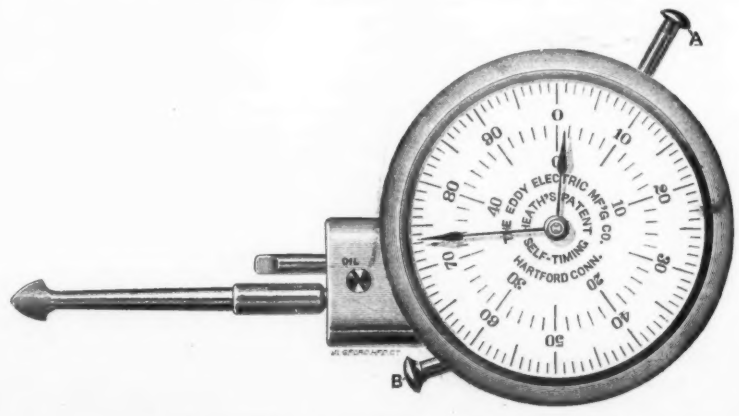
A pinion box holds these parts in proper relation to each other, and with the body of the instrument.

The counting and registering apparatus consists of a worm and gear, with which are connected the hands, each being provided with a heart cam, as in the case of a "fly-back" watch.

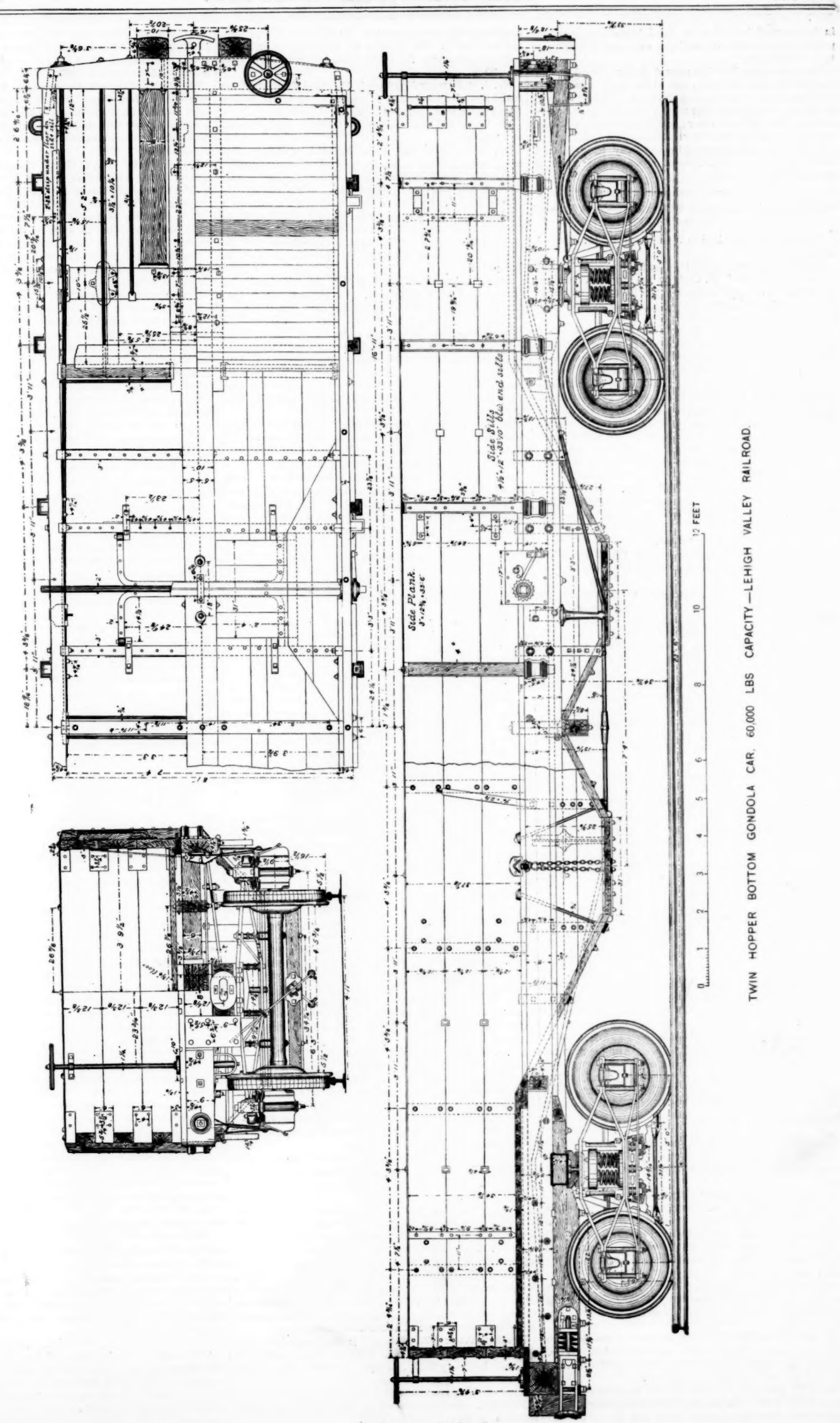
There are also necessary motion wheels and pinions to secure the proper relative motion of the hands.

The time mechanism includes a strong non-magnetic lever escapement, which is operated by a spring attached to the pawl wheel, and this receives the same impulse whether the speed being taken is high or low. The parts of the instrument are held between plates in a manner similar to those of a watch, and are inclosed in a neat and substantial case.

In using the indicator, the setting pin *A* is firmly pressed inward until it stops, which sets the hands at *O* and winds the power-spring. Then the point being attached, as in the cut, or in case the shaft runs in the direction followed by the hands of a clock, to the upper pinion, the point is placed



HEATH'S PATENT SELF-TIMING SPEED INDICATOR.



TWIN HOPPER BOTTOM GONDOLA CAR. 60,000 LBS CAPACITY—LEHIGH VALLEY RAILROAD.

in the centre of the shaft to be timed, brought as nearly as possible in line with it, and held with sufficient firmness to prevent slipping.

The starting pin *B* is then pressed firmly inward and released; this starts the hands, and at the same time releases the time-train. The instrument must then be held steadily in place until the hands stop, when the rate of speed may be read on the dial—the outer graduated circle indicating revolutions, and the inner one hundreds of revolutions.

This device is manufactured by the Eddy Electric Manufacturing Co., of Windsor, Conn., of whom any further information may be obtained.

Roadmasters' Association of America—Sixth Annual Convention.

This convention was held in Washington, D. C., Sept. 11, 12 and 13.

The first session was called to order at 10 o'clock Tuesday morning, President. J. W. Craig in the chair. There were present about 75 to 100 members. The Secretary reported a present membership of 348, and about 60 new members were elected, making a present total of 408.

The first hours of the session were given to election of members and other routine business. In the course of this business the correspondence with various railroad companies concerning free transportation for members of the Association was read. It appeared that there had been considerable reluctance felt by railroad officers to violating the Inter-state Commerce law by passing the roadmasters, but eventually this was gradually overcome to a great degree, and it is believed that as the work of the Association is better understood and appreciated, the law will be found more flexible.

An invitation was received from the Mayor and Chamber of Commerce and Board of Trade, of Denver, Col., to hold the next annual convention at Denver.

The session was adjourned to 3 o'clock that a fuller attendance might be secured before attacking the important subject of rail joints.

RAIL JOINTS.

At the opening of the afternoon session, the Committee on Standard Track Joints presented the following majority and minority reports:

Majority Report.—The undersigned, a majority of the Committee on Standard Track Joints, beg leave to submit the following report: That the best device now known to them for a standard joint is the angle bar. That this angle bar should be from 42 to 44 in. in length, with slots for spikes 2 and 6 in. from the ends, with six bolt holes, spaced from 5 to 7 in. apart, resting on three ties, 9 × 7 in. and 8 in. apart, weight 60 lbs. per pair for a 60-lb. rail, and increased proportionately for increased weight of rail, shaped to conform to the head and flange of the rail, allowing about $\frac{3}{8}$ in. space between the splice and the web of the rail, to permit of tightening. The cross section of joint shown by fig. 6, page 28, of annual report for 1887, meets our views as to shape and fit. The bolt holes in both plates should be oblong in form, and round or button-head bolts, elongated under the head to fit the oblong hole in the plate, be used. For rails weighing from 60 to 70 lbs. per yard a splice bolt $\frac{3}{4}$ of an inch in diameter, with a square nut of the proper size, should be used when practicable; and for rails weighing over 70 lbs. per yard a bolt $\frac{7}{8}$ of an inch in diameter of the same form should be used, and a metal washer or spring should be used between the nut and the plate. As far as we now know we are in favor of giving the angle bar, made heavy in the centre and tapered towards the ends, a more extended trial before deciding on its merits over one of a uniform thickness throughout. That we decidedly prefer a supported joint to what is generally known as a suspended joint.

P. NOLAN,
A. B. ADAMS,
T. HICKEY.

Minority Report—The undersigned, a minority of the Committee on Standard Track Joints, submit the following report: That we still adhere to all the recommendations for a standard joint named in the report submitted at the Cleveland meeting in 1887; and we further say that it is our opinion and belief that a suspended joint having all the qualities named in that report, and in addition to be from 28 to 30 in. in length and having 6 bolts, has all the essential features required for a standard track joint, and herewith submit blue prints of a section and side elevation of what we hereby recommend for a standard track joint. R. CAFFREY,
H. D. HANOVER.

The section recommended by the majority has top and bottom flanges, but not so heavy as those of the section recommended in the minority report, which is the Fritz-Sayre joint.

The reports were accepted for discussion.

Discussion.—Mr. W. H. COURTNEY (Lake Shore): The 30-in. joint is too short for a double track. He would use a steel splice to weigh 40 lbs., and with three ties, supported.

Mr. C. W. BURGDORF (Union Pacific) has in use angle bars of various lengths. He would favor a 42-in. angle bar with 4 holes, supported.

Mr. S. L. SWINNEY (W., St. L. & P.) is in favor of the majority report, so far as supported joint goes, but has had no experience with long splices. He would, however, be in favor of them.

Mr. HICKEY (Michigan Central) has used a three-tie splice with good results. Those now in use are 44 in. long, 65 lbs. per pair. The angle bars are slotted for the centre tie, but the slot is $1\frac{1}{4}$ in. from the end of the rail.

Mr. J. H. LINSLEY (C., B. & Q.) has experimented with almost every joint. The objection to the long six-hole splice is the friction between the angle plates and the rail, which interferes with the movement of the rail ends in expanding and contracting. The question of suspended or supported joint is a minor one. He sees no advantage in a joint of more than 30 in.

Mr. J. P. RAMSEY (Cincinnati, Hamilton & Dayton) has found that plates slotted at the middle break in the bottom flange which is an objection to supported joints.

Mr. COURTNEY had never known a joint to begin to break at the bottom.

Mr. H. W. REED (Savannah, Florida & Western): The minority recommends a greater concentration of metal in the top and bottom flanges of the splices, giving greater strength as a beam. As to length he is not yet prepared to give an opinion. He never knew a bar to begin to rupture at the bottom. The recommendation of the Committee to put the holes nearer the ends, he thinks well of as lessening the play of the ends. He prefers the short splice because of the objectionable amount of friction between the rail and the long plates.

Mr. A. B. ADAMS (W., St. L. & P.): The standard joint of his road is 26 in., suspended. The joint gets low and the plates wear in the middle. He has had good results from a 34-in. joint, and from what he has seen of other roads he would recommend a long splice, supported.

Mr. P. NOLAN (New Orleans, Texas & Pacific): He has had supported joints slotted in the middle break from the bottom, but the suspended joint breaks at the top. A suspended joint offers advantages of elasticity while it is new, but as it bends the set becomes permanent, and he prefers a 3-tie joint, supported.

Mr. D. H. LOVELL (Pennsylvania) has not had enough experience with the long splice to speak with confidence, although he has used for some years a 34-in. iron splice. He is inclined to recommend a short, heavy steel splice.

Mr. ROBERT BLACK (Manhattan Elevated) used a 54-in. bar and found them to break in the top flange. Is using now a 37-in. bar, supported, six-hole, and with good results. These long splices do not fit tightly to the web, but have sufficient space to allow for taking up for wear. Has three miles laid with the Clark-Fisher joint, which he finds very satisfactory when well kept up. Has tried a mitred rail with the Clark-Fisher joint and considers it a failure—with angle plates it might answer. The Samson was tried on a 50-lb. rail and broke just at the reinforcement. Out of 200 bars 40 broke.

Mr. JAMES SLOAN (C. & E. I.) had had the same trouble with the Samson. Some 7,000 or 8,000 had been removed from his line. They broke just at the jog where the reinforcement ends.

Mr. I. BURNETT (Joliet Steel Works) showed a blue-print of the Chicago, Milwaukee & St. Paul thickened splice, and explained that the bends which had existed at rail ends where the short suspended joints were taken out, had nearly disappeared with the use of the long heavy splice supported.

Mr. CAIN (W., St. L. & P.): The weight of the angle bar, the quality of the material and the spacing of the ties should all be proportioned to the weight of rolling stock. He would use a 26-in. joint, of steel, and ties 6 or 8 inches apart. The angle bar has not been increased in proportion to the increase in weight of rail.

Mr. BURGWIN (Grand Rapids & Indiana): Five-sixths of all broken rails were broken through the bolt holes. He would suggest that there are too many bolt holes in the joint recommended by the minority. There are four holes unsupported (between the ties) and two close to the edge of the tie.

Mr. ELLIS (Providence & Worcester) described his joint, which was mentioned in the report of the New England Roadmasters' Convention. It is a 24-in. angle plate, suspended with heavy top and bottom flanges. The outside plate is $\frac{7}{8}$ in. thick at the middle of the web, and the inside plate is $\frac{5}{8}$ in. thick. He uses a wide bottom flange to give a deep slot, and does not bring the flange down to the tie. He has very good results, but would favor a steel angle bar.

Mr. HYLAND (Cheshire) has laid a 72-lb. rail both supported and suspended and prefers the suspended. He has some 20 miles laid with Fisher and finds trouble from creeping.

Mr. J. H. PRESTON (Chicago, Rock Island & Pacific) He is inclined to agree with the minority report. Still a joint involves the consideration of many facts and conditions and his mind is not made up as to best form. He has had experience with nothing longer than 26 in. He is rather in favor of a supported joint. He thinks, however, that the roadmasters are not yet prepared to vote definitely as to one or the other form of joint.

Mr. MANDEVILLE (Lehigh Valley) has had no experience with a joint longer than 30 in. He would advise trying long joints. A comparative trial is the only way of deciding the matter.

Mr. MULKAHY (C. & W. M.) would favor a 36 in. angle bar, with 4 holes and 3 ties under the joint. This is the joint now in use on his road. The rail is 67 lbs.

Mr. W. H. STEARNS (Chicago & Northwestern) uses a 34-in. angle bar, supported. The three duties of an angle bar are to keep the rails in line, in surface and hold the ends together. He thinks these three duties can be fulfilled perfectly with a 34-in. angle, supported. That gives sufficient bearing on the ties, and permits the slots to be made at favorable points. He is decidedly in favor of a supported joint.

Mr. MELLVILLE (W., St. L. & P.): He has used no long splices. He uses a 52-lb. rail. Does not think a suspended joint safe for heavy traffic. Thinks the splice should be just long enough to take the three ties.

Mr. J. A. KERWIN (Chicago & Northwestern) would favor a 3-tie joint, one tie under the joint, and the others spaced according to the length of the joint.

Mr. BURNETT (Joliet Steel Works) would advocate a 3-tie joint, supported. The weight and length of joint should be governed by the spacing of ties and weight of rail, that, of course, to depend on the traffic.

Mr. J. M. JACKSON (Jacksonville Southeastern): He would use a 42-in. plate $\frac{7}{8}$ in. thick on the outside, and as thick inside as the wheel flanges would permit; or he would use a 24-in. plate with the same amount of metal as that in the 42-in. The long splice should be supported and the short one suspended.

Mr. COURTNEY (L. S. & M. S.): Has gone from a 26-in. to a 48-in. splice. This length is used with reference to the spacing of ties. He thinks three ties necessary to prevent creeping. He would use a steel plate.

D. R. KITTELL (Chicago & Northwestern): He is using a 26-in. suspended joint and a 34-in. supported, and he does not think that he has a joint that is up to true surface.

Mr. LINSLEY (C., B. & Q.) uses a 66-lb. rail, 26-in. splice, 36 lbs., mostly suspended. Have found best results with suspended joint.

The following were by letter:

Mr. ROACH (O. & M.) would have a 40-in. joint, supported and plates thickened at the middle—steel. The angles should be slotted for spikes, 2 in. from each end, but not slotted for the middle tie spikes. The bolt holes should be but four, and allowance for expansion to be made by slack fit of bolts in the rails. His opinion is formed largely from observation of the Chicago & Alton joint.

Mr. DICKSON (Pennsylvania) recommends a 6-hole, 3-tie joint supported and 36 in. long. This for a 70-lb. rail. For a heavier rail, he suggests a 40-in. splice of heavier weight.

The two sessions of the afternoon and evening occupied $5\frac{1}{2}$ hours, and at 10 p. m. an adjournment was taken to 9 o'clock Wednesday morning.

At the session of Wednesday morning the subject of Track Joints was resumed. On motion of Mr. Ellis (P. & W.), a resolution was adopted referring the majority and the minority reports back to the Committee with instructions to report at the next convention. Roadmasters who can do so are recommended by the resolution to make comparative tests of the 3-tie supported joint and the heavy, suspended joint, under similar conditions of track and traffic.

SNOW AND SNOW PLOWS

The Committee on Snow and Snow-plows recommend for snow of 3 ft. or less an iron snow-plow similar to that used on the Chicago, St. Paul, Minneapolis & Omaha, of which a blue print was shown. They recommend that the plow be followed by a second engine for a "drag out," and that enough men be provided with the snow train to clean out flanges, etc. In stormy weather it is desirable to have a second plow following headed backwards to prevent the outfit being blocked between stations. The Committee also recommended a flanger to be worked by air from the engine.

For heavier snow the Rotary is recommended.

Three lines of snow fence are recommended, set respectively 75 ft., 100 ft. and 125 ft. from the track.

SPECIFICATIONS FOR CROSS TIES.

The report of this Committee was discussed and voted upon in sections, and after some amendments was adopted as a whole. The report recommends:

(1) For ballasted track a tie 7 in. deep, 8 in. face and 8 ft. long.

(2) For all soil ballast a tie 7 in. deep, 10 in. face and 9 ft. long.

(3) Certain timbers are specified in the order of preference.

(4) Seventeen ties are recommended for a 30-ft. rail, spaced $21\frac{1}{4}$ in. c. to c., heart side up.

(5) No recommendation is made with regard to metal ties or methods of preservation, as the Committee knows of no process which has paid.

In the discussion which preceded the adoption of this report some opposition was made to the dimensions, particularly to those specified in the second section. Several members considered it practically impossible to get ties so large, and that it was not wise to recommend such dimensions. Others, and especially the members from the South, said that it is rather a matter of local conditions, and that where ballast is not used the large ties are essential, and fortunately they are still to be had at reasonable prices in the South. It was thought by some that as it is important to keep the bearing on ties as nearly as possible uniform, it would be better to use a tie of narrower face, particularly as the increasing scarcity of timber necessitates cutting ties as they come, and if a narrower face is specified as standard there will be less likelihood of much variation from it in any given piece of track. Some of the Southern members thought that some 12,000 miles of track in the southern states would be best kept up by the use of a 10-in. tie 9 ft. long, and they would not be willing to have it thought that they assented to the use of anything less.

It was said by Mr. Patch and others that there is good economy in seasoning ties a year before they are put in the track.

At the afternoon session on Wednesday the first subject taken up was that of Standard Hand Cars. The Committee submitted a report specifying weights and dimensions, but not recommending any special make. The report was adopted.

FROGS.

A letter from the President of the American Railroad Superintendents' Association was presented, submitting the report of a committee of that body on solid and spring rail frogs, and asking an expression of opinion from the Roadmasters' Association thereon. President Craig caused to be read certain correspondence of 1886, showing that action on

the matter of standard frogs originated in that year with the Roadmasters, and that the report of the Superintendents' committee was based on specifications adopted in 1886 by the former body.

Mr. NOLAN (Alabama Gt. Southern), Chairman of a Committee on Standard Frogs, submitted a report. On resolution the subject was carried over to the next annual meeting, the members to be furnished with blue prints, etc., that meanwhile they may make a careful study of the matter.

Mr. BLACK (Manhattan Elevated) was asked to give some statement of experience with ties treated for preservation and with tie plates. He said that in 1884 the Manhattan put in 5,000 ties treated by "vulcanizing," 85 creosoted ties and 5,000 ties not treated. These were all yellow pine. On examination recently it was found that the natural timber had decayed badly while the creosoted and vulcanized ties were as sound as when they were put in. They were worn under the rails, but otherwise perfect. The vulcanizing process consists simply in subjecting the timber to high heat while under pressure. They have had in use also some 20,000 ft. of lumber in flooring, etc., treated with the fernoline creosote, and are so well satisfied with the results that 500,000 ft. more will be put in.

They have some 16,000 steel tie plates, $6 \times 8 \times \frac{1}{4}$ in., in use. They have found the life of the tie so much increased by the use of the tie plate that they have ordered 20,000 more. In answer to questions Mr. Black said that there was no noise from the use of the plates.

Mr. OFFUTT (Long Island) uses a good deal of creosoted piling. In the ground connections of his interlocking work is using fernoline treatment. Is using creosoted timber for the underground work of crossing gates.

LABOR ON TRACK.

Mr. JORDAN (Michigan Central), Chairman of the Committee on Labor on Track, read a report. After considerable discussion the report was referred back to the committee for report at the next meeting, the members to be supplied with copies of this report for consideration in the meantime.

Mr. SWINNEY (W., St. L. & P.), chairman, read a report on Mr. Charles Latimer, being a brief sketch of his career and tribute to his memory. The report expressed the affection and gratitude of the trackmen for the man who had done more than any one other man for them.

The Association then proceeded to the election of officers, with the following results:

Member of Executive Committee, to serve three years, R. Black (Manhattan Elevated); Secretary and Treasurer, H. W. Reed (Savannah, Florida & Western); Second Vice-President, James Sloan (Chicago & Eastern Illinois); First Vice-President, I. Burnett (Joliet Steel Works); President, J. W. Craig (Charleston & Savannah).

Denver was chosen as the place of the annual meeting in 1889.

A resolution was adopted expressing the thanks of the Association to the Baltimore & Ohio as being the only road running into Washington which honored the credentials of the Association by giving the members transportation.

At 1.30 p. m. on Wednesday the members of the association with their guests were received by the President of the United States, at the White House.

EXHIBITS.

The Pennsylvania Steel Co. exhibited a three-throw split switch, a single split switch, spring rail and solid frogs, and their well-known switch stands. They showed also their new magneto-electric semaphore signal and their magneto-electric highway crossing signal. The magneto-electric semaphore is in use, with a hand generator, as a local signal by a number of companies; and with a track generator, as an automatic block signal it is in use for trial on the Chicago, Milwaukee & St. Paul, and arrangements are about concluded to equip 20 miles of double track on another road.

The Rotary Steam Snow Shovel Co. exhibited photographs and illustrations of the rotary.

The A. French Spring Co. showed the Noble nut lock and washer.

Mr. J. B. Suffern showed his safety switch, described in the *Railroad Gazette* of Aug. 17, page 538.

The Ramapo Iron Works exhibited a model of the automatic safety switch stand.

H. Chance, Fostoria, O., showed his solid steel safety frog.

The Fernoline Chemical Co., of New York, showed samples of fernoline oil and of wood treated with it.

The Kalamazoo Railroad Velocipede & Car Co. showed a standard section hand car.

The Buda Foundry & Manufacturing Co., of Buda, Ill., showed a standard section hand car.

The Sheffield Velocipede Car Co. showed a velocipede car and a standard section hand car.

Ruffner, Dunn & Co. showed their well-known Excelsior nut lock.

The Palmer Torpedo Railway Signal was shown by the company of that name.

The National Lock Washer Co., of Newark, N. J., showed their lock washer. They showed a new design to be used with very small bolts, for carriage work, etc. This washer embodies the same principle as that heretofore made by the company for larger work.

The Servis tie plate was shown by the Dunham Manufacturing Co.

Pettibone, Mulliken & Co., of Chicago, showed the roller rail bender, the Jeune track jack, the Union and perfection track drills, the Monitor iron switch lamp, and the Atkins forged steel rail braces.

The Ajax Forge Co. showed their switches, frogs, crossings, etc., and their well-known steel rail brace.

Metcalfe, Paul & Co. showed the Verona nut-lock and blue prints of various track tools.

Wier Frog Co., Cincinnati, showed the prints and photographs of their well-known devices.

The Elliott Frog & Switch Co., St. Louis, distributed a handsome catalogue of their frogs and switches.

The Bush Interlocking Bolt Co., Philadelphia, showed samples of the Bush interlocking bolt.

The Marion Steam Shovel Co., Marion, O., exhibited a model of their ballast unloader.

The Batt & Hager Safety Switch Co., Buffalo, showed a model of a safety switch.

Manning, Maxwell & Moore, New York, showed Smith's portable rail saw.

Andrew Warren, St. Louis, showed a lever, track-jack, track drill and track gauge.

The National Ballast Co., Chicago, showed samples of burned clay ballast.

Mr. C. L. Cooke, of Syracuse, N. Y., showed a model of a safety switch now in some use on the Canadian Pacific.

The McKenzie rail joint was shown by John McKenzie, Green Island, N. Y. It is of the chair type. Two symmetrical parts, of malleable cast iron, are slipped over the rail ends. The two parts are so shaped that each one supports a part of the foot of both rails; and the joint is shaped to the section of the rail so as to support the head and web also. No bolts or nuts are used. One hole is drilled in the end of each rail, and a pin goes through the chair and rail. The spike-head keeps this pin in place. The joint is made from 10 to 16 in. long, and weighs from 15 to 35 lbs. A few of these joints are on trial on five different roads, and the Manager of the Crown Point Iron Co.'s Railroad says that they are proving very satisfactory.

The Hitchcock Reclining Chair.

The chair illustrated in the accompanying engravings embodies numerous improvements in the construction of reclining and revolving chairs for railroad car use suggested by the long experience of the makers, Messrs. Adams & Westlake.

All parts of the frame are made of steel and cast brass, except the pedestal, which is of cast iron. The frame is of brass, with the sides of an ornamental pattern, finished in oxidized bronze. The arms and seat frame are of cast brass. The extension foot-rest is also of brass, while the rods supporting the foot-rest are steel. The pivot-rod connecting chair and pedestal is of 1-in. solid steel.

THE HITCHCOCK RECLINING CHAIR.

Made by THE ADAMS & WESTLAKE CO., *Chicago, Ill.*

The head-rest is adjustable, and will remain in any position, but is without annoying springs or catches. The extension foot-rest is supported by a steel rod on either side, nickel plated, and is said to be capable of bearing a weight of 500 lbs. When not in use this rest is folded, and slides under the chair.

The adjustment is simple, being controlled by hand-levers at either side.

The engravings show very clearly the different positions which the chair can be made to assume. The makers guarantee these chairs to stand more than the ordinary wear and tear of railroad service.

These chairs were first used by the Chicago & Alton, and the improvements since made have been largely due to the experience gained on that road, which has been extensive. The chair illustrated is now largely used on the Chicago & Alton, Illinois Central and Wabash.

Railroad Gauges of the World.

From a comprehensive review of the history and development of the railroad gauges of the world by Herr Claus, in *Glaser's Annalen*, the following particulars in regard to the gauges of the world are extracted. After a battle of the gauges, 4 ft. 6 in, 4 ft. 8½ in., 5 ft. 0 in. and 7 ft. 0 in., it was agreed in England about 1848 that a uniform gauge of 4 ft. 8½ in. should be used on all new roads, except those already served by the 7 ft. 0 in. gauge. The first German road from Nuremberg to Fürth was built with 4 ft. 8½ in. gauge, which is now used by all the principal roads of Germany, although there is a very considerable mileage of narrower gauges, mainly 1 metre, or 3 ft. 3⅜ in. France started her roads with a width between rail centres of 4 ft. 11 in., which has led to some slight variations of gauges, according to rail width. The later roads have been built with a gauge of 4 ft. 8½ in. Holland began with a 6 ft. 4 in. gauge, but has now altered all its roads to 4 ft. 8½ in. The Railroad Congress at Bern in May, 1886, adopted the following resolution, which is to apply to Germany, Austria-Hungary, France, Italy and Switzerland: "The gauge of railroads measured between the inner edges of the rail heads shall, for roads built or altered as to gauge after this resolution takes effect, not be less than 4 ft 8½ in. on straight lines, nor more than 4 ft. 9½ in. on curves."

In Russia the first road opened in 1838 from St. Petersburg to Zarskoe-Selo, about 16 miles, had a 6 ft. gauge. When the second road was made in 1842 from St. Petersburg to Moscow, the Czar, at the instance of our countryman, Major Whistler, fixed the Russian gauge at 5 ft., which increase over the English gauge was thought desirable for locomotive purposes. Major Whistler thought as wide a gauge as 6 ft. uncalled for. The 5 ft. gauge has continued the standard in Russia; but that it was not made different from the German gauge for military reasons, seems to be proved by the fact, instanced by Herr Claus, that the lines built under imperial direction from Warsaw to Vienna, and from Warsaw to Bromberg (the Berlin line) were carried out with the German gauge. The history of American gauges is briefly and intelligently reviewed, without reference to the narrow gauges; the author confining himself to the standard gauges of the world for the most part.

Ireland has a standard gauge of 5 ft. 3 in.; Spain and Portugal, 5 ft. 6⅜ in.; Sweden and Norway have the 4 ft. 8½ in. gauge over the majority of their railroads, but 20 per cent. of the Swedish roads have other gauges varying from 2 ft. 7½ in. up to 4 ft. Norway has 592 kilometres of standard gauge and 970 kilometres of 3 ft. 6 in. gauge.

In Asia, of the British-Indian roads with a collective length of 12,366 miles, about 7,450 miles have a gauge of 5 ft. 5⅝ in., the remainder being divided among six gauges from 2 to 4 ft. Of the narrow gauges, the most prevalent, embracing 4,200 miles, is the metre, 3 ft. 3⅜ in. The Ceylon railroads have the standard Indian gauge. The Russian trans-Caspian lines have the Russian standard gauge of 5 ft. In Asia Minor the line Mudania Brussa has a gauge of 3 ft. 7¼ in. The island of Java has 449 miles of 3 ft. 6 in. gauge and 126 with 4 ft. 8½ in.

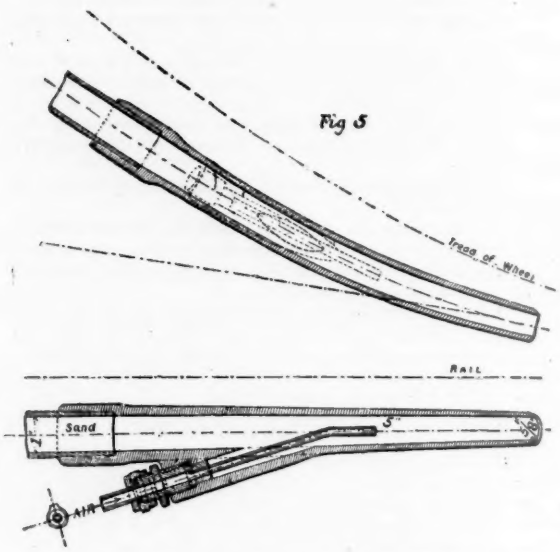
In Japan, with the exception of an 8-mile piece begun in 1885, with a gauge of 2 ft. 9 in., all the roads have a 3 ft. 6 in. gauge.

In Africa, the Egyptian railroads, amounting to 932 miles, are of the 4 ft. 8½ in. gauge. Algiers and Tunis, with 1,203 miles in 1884, had the 4 ft. 8½ in. standard on all except 155 miles, which had a 3 ft. 7¼ in. gauge. The English Cape Colony had in 1885, 1,522 miles, all of 3 ft. 6 in. gauge.

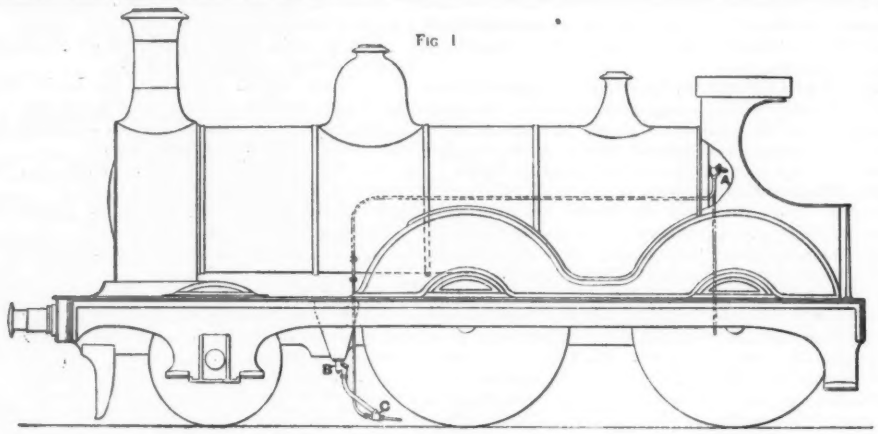
In America, apart from the comparatively small mileage of United States roads with 3 ft. gauge, practically the whole of the United States and Canadian railroads are of 4 ft. 8½ in. to 4 ft. 9 in. gauge. In Mexico, in 1884, 2,083 miles were 4 ft. 8½ in., and 944 3 ft. gauge. In Brazil, at the end of 1884, there were 869 miles of 5 ft. 3 in. gauge, and 4,164 miles of various gauges between 2 ft. and 4 ft. 7 in., over 3,700 miles being 1 metre, or 3 ft. 3⅜ in., so that this may be considered the standard gauge of Brazil.

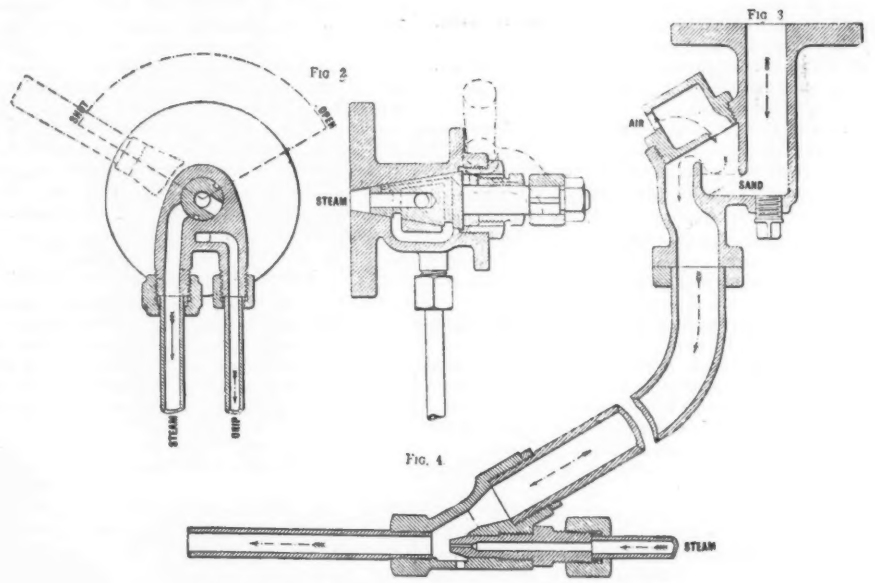
In Australia the different colonies, rather singularly, have different gauges, that of New South Wales being 4 ft. 8½ in.; Victoria, 5 ft. 3 in., South Australia, 5 ft. 3 in. and 3 ft. 6 in., and the other colonies 3 ft. 6 in.

The total mileage in operation in the world at the end of 1885 was 303,048 miles of this length. Seventy-four per cent. were of the 4 ft. 8½ in. to 4 ft. 9 in. standard, 12 per cent. had larger gauges and 14 per cent. smaller.



Compressed Air Sanding Apparatus for Locomotives.





STEAM SANDING APPARATUS FOR LOCOMOTIVES.
Made by MESSRS. GRESHAM & CRAVEN, *Manchester, England.*

Steam Sanding Apparatus for Locomotives.

The accompanying engravings represent a steam sanding apparatus which has during the last two years come into very general use on English railroads, and has been adopted or is being tried on the government railroads in Denmark, France, Sweden, Germany, Portugal, Natal and New South Wales, and on private lines in France, Belgium, Spain, Russia, Austria and elsewhere.

It is well known that a strong side or head wind will blow all or most of the sand on one side as it leaves the sand pipe, and thereby prevent the sand falling on the rail in front of the wheel. The sand is also apt to be blown or washed off the rail itself. The apparatus is intended to remedy these defects, and render certain the delivery of the sand on the rails under all conditions. A jet of steam forces the sand on to the rails with sufficient force to insure the sand reaching the right point. It is argued that when the sand is allowed to fall by gravity alone, its momentum is not sufficient to overcome the force of the wind, etc. It is also claimed that the quantity of sand delivered can be more efficiently controlled by the use of the steam jet than is possible with the ordinary sanding apparatus and gear.

Referring to the illustrations, fig. 1 shows a side elevation of a locomotive fitted with the complete apparatus, and figs. 2, 3 and 4, vertical sections of the details. It will be seen from fig. 1 that the arrangement consists essentially of three parts: The steam valve *A* for supplying and regulating the steam to the ejector, a sand trap *B* which can be fitted on existing sand boxes, and the small ejector *C*, which lifts the sand, and impels it under the wheel at the line of tread. In this apparatus it has been found desirable that the steam should be perfectly dry, and an ingenious method of accomplishing this end may be seen in the steam valve section (fig. 2); the condensed steam which accumulates being allowed to escape through ports in the plug, and conducted away by a drip pipe, which terminates under the foot-plate near the back of the fire-box, a warm spot, where the drip is not likely to freeze and block the exit.

Fig. 4 shows the sand trap which is fitted to the bottom of an ordinary sand box. The sand falls down the open pipe and passes through the horizontal opening shown, and were it not for the vibration of the engine, would take up a sloping position as shown by the inclined dotted line. Owing to this vibration, however, it finally takes the position shown by the horizontal dotted line, at which it remains till steam is turned on through the ejector shown at the bottom of the sand pipe, see fig. 4. This is done by the engineer opening the steam valve *A* in the cab, as shown on fig. 1. The flow of the steam produces a partial vacuum in the sand pipe, causing air to be drawn in through the air inlet. This air is deflected down on to the sand, as shown by the arrows, and carries it with it over the weir down the sand pipe to the ejector, which blows it on to the rail.

The small hole shown just below the ejector nozzle (fig. 4) prevents any accumulation of sand when steam is shut off.

The makers, Messrs. Gresham & Craven, of Manchester, England, claim the following advantages for this system: The use of coupling rods may be dispensed with, as a single engine fitted with this apparatus has as much adhesion as a coupled engine without it; great saving of sand, as the apparatus is able to deliver in large or small quantities; absolute certainty of delivering at the position required, irrespective of wind; simultaneous delivery to both wheels, thus minimizing the liability to injure or strain the driving axles; and no rods or levers are required for working the gear. No additional train resistance is caused, as no superfluous sand is left on the rail, and by the prevention of slipping some economy in fuel is effected.

Another method of forcibly delivering sand on the rail is shown in fig. 5. A jet of compressed air is used instead of steam from the boiler. The air can be supplied by the Westinghouse pump, but it is advisable to use a separate reservoir to store the air, keeping it distinct from the air used for the purposes of the brake.

The Forth Bridge, and Some Discussion on Bridge Steel.

At one of the sessions of the recent Edinburgh meeting of the Iron and Steel Institute (British) a paper on the Forth Bridge was read by the Resident Engineer, Mr. F. E. Cooper. The paper dealt chiefly with the details of erecting, of which a pretty full account was given not long since in the *Railroad Gazette*. We will not, therefore, reproduce any part of Mr. Cooper's paper.

Immediately after the reading of the paper Sir I. Lowthian Bell referred to the presence of Mr. T. C. Clarke, of New York, and his connection with bridge construction in America, and suggested that the members would be glad to hear his views on the subject of the Forth Bridge, Mr. Clarke was highly esteemed, not only in America, but in England, and he had particularly distinguished himself in the construction of bridges of novel design.

Mr. Clarke said that, after the very flattering manner in which his esteemed friend, Sir Lowthian Bell, had introduced him, he might almost take upon himself to speak of the Forth Bridge as one having great authority, and in an ex-cathedra manner, but in reality he experienced great modesty in approaching the subject. The work was of such a novel nature and so different from anything which had ever been done before, that he felt extremely modest in giving an opinion at all. * * *

The first point that would attract attention was that the bridge was not only a very strong one, but that it carried to the eye the appearance of stability which every bridge ought to have. The enormous width of the foundations, where they rested upon piers 120 ft. wide, tapering up to a narrow point of 30 ft. wide at the top, and coming out at the centre of the span to the same width, showed a broad-bottomed appearance of stability, so that when anybody looked at it, he would say, "There is a bridge which no gale or tornado can upset." When they looked at the bridge, they would see that it was a great object lesson in the mode of calculating the strains upon frame structures, because all the parts in compression were tubes, and all the parts in tension were lattice girders, which could be very easily distinguished from each other, so that they would see how the strains worked. They would also admire the manner in which the weights were carried, by the shortest and most direct lines, to the points of support without any crossing backward or forward, as in some designs he had seen, where the weight, instead of going directly down, went zigzag. Everything was done in a plain, common-sense manner.

The great difference between the Forth Bridge and all other bridges, not only in American practice, but in previous English practice, was the fact of the great concentration of material along the lines of strains; in other words, there were a very few large parts instead of a great many small ones. The reason for that was very obvious, namely, to expose as little surface as possible to the enormous force of the wind, particularly in an exposed place like the Forth, where the wind-pressure, as the author had stated, very much exceeded the pressure due from the gravity of trains, even supposing the bridge were covered from end to end with locomotives. By the adoption of the plan of giving as little surface as possible the pressure was diminished, and it had led to an entirely different kind of construction from that which had previously been attempted, at least that he was aware of up to the present—namely, that, instead of the parts being made at the shops at a distance, brought by rail to the site, and put together there, the shops were brought to the ends of the bridge. They made all the material, drilled, planed, and prepared it there, and then it was built up in position, as a spider spun his web. The formation of the joints between those enormous tubes was a matter which excited a great deal of curiosity on the part of some of the American engineers.

The construction of the centre span had also excited some question, but, as he understood, the method of doing it would be a perfectly simple one. The two cantilevers would be extended until they met together in the centre. In order to do that, sliding joints at the two ends of the suspended span would be temporarily converted into fixed joints, so that they would have no motion. After a junction had been made, they would be re-converted into sliding joints, and they (the cantilevers) could expand each way. It was a thing that had been done successfully several times in America, and it could be done elsewhere. He wished to indorse in the most complete and thorough manner everything Mr. Cooper had said as to the excellence of the steel used in the Forth Bridge. As he had used many thousand tons of it in his own practice he knew that it combined in itself those qualities which they especially asked for in the steel used for the construction of bridges, namely, not only great strength, but great tenacity, and, above all, uniformity. That uniformity of construction was found in soft steel alone; in hard steel, as applied to bridge purposes, they could not quite depend upon it; but the moment they came to a metal with the qualities of the steel used in the Forth Bridge, then they found a steel which could be tied in a knot, and it was always uniform.

One difference in the practice of the construction that he had noticed was that in America they did not drill their rivet holes, they preferred to punch and then ream them. Experiments had shown that punching, and reaming afterward, gave the same or very nearly the same strength, while the punching was the most admirable test of a material, because a material that would split under punching was a thing that was not wanted.

He believed it would not be possible to appreciate fully the great architectural merits of the Forth Bridge until the scaffolding and appliances which now covered it were taken away and the main lines met in the centre. When that was done he believed it would be found to be one of the finest pieces of architecture in the world. It was perfectly true that it would lack ornament, either constructive or applied;

but the pyramids of Egypt had no ornament, and they needed none, and the same thing might be said of the Forth Bridge.

The President said it was well known to the members that he had had some considerable experience in steel structures and in the composition of metal to give stability and security, and he congratulated members on the very wise selection of the elementary composition of the metal used in the bridge.

They had all been delighted with the explanation given by Mr. Clarke, and he indorsed all that that gentleman had said, except his reference to the American practice of punching. One of his friends had remarked that a man who injured a good steel plate by punching deserved to be punched himself. If Mr. Clarke would follow the British practice of drilling, he would find that it was not more expensive in the long run, and that it was much more desirable. To have the steel tested by the act of punching was like locking the stable door after the horse had been stolen. There was no method of satisfying the engineer that the material was a right one except analysis previous to its use. If they depended upon mechanical details alone, he was afraid that they might often get a very unsuitable material for any given purpose.

Mr. Henning said he was connected with some large bridge work in America, and was able to state that they were now beginning to drill. It was certainly not the universal practice to punch. Now that they had begun to drill he had no doubt that they would continue the practice. He thought that one of the principal features of the Forth Bridge was that the work was so carefully treated and drilled instead of being punched, which, he considered, was not by any means a good process.

Mr. Clarke said that when he spoke of the practice of punching and reaming as contrasted with drilling, he referred to a softer quality of steel than that used in the Forth Bridge, the specification of which was from 30 to 33 tons, the steel that he referred to being from 27 to 29 tons. He was satisfied from long observation that the latter was not injured by punching and reaming.

The President said he still recommended Mr. Clarke to adopt drilling. He would find as he (the President) had found after a very short experience that drilling was cheaper than punching.

Mr. Cooper said he thoroughly agreed with the President on the question of drilling versus punching. He might put shearing in the same category as punching. They had found that both punching and shearing were brutal treatments of a very sensitive material. They did more damage in that way than in any other. They might bend the metal cold, or do anything in reason with it, but to punch a hole through it, and then play with it, or leave it alone, was destruction. Their practice hitherto was to eliminate as much as possible the strains arising from shearing, because planing was the only thing they permitted. Of course, the plates came into the works sheared from the steel company, and they entirely eliminated the strains by planing the edges of the plates all round. With regard to punching he could not say that it was cheaper than drilling. In the case of the Forth Bridge, with massive pieces of work like the top members with five or six plates, they could not punch them all at once, but they could put them in their place and run the drill through them quickly, and then when they were once drilled no more fitting was required. In the case of awkward parts of the junctions, where there were curved plates overlapping, and where they had to be fitted in the yard, the drill did not go straight through where it ought to go, and the consequence was that, when the pieces were put together, the holes were not quite true. They then had to adopt the plan of reaming referred to by Mr. Clarke, which was very expensive.

Many persons had said with regard to the building of the centre girder: "That is your most difficult job; will you not be glad when the keystone is put in?" He then had to explain that the centre girder was not a keystone, but only an encumbrance. Of course they would use it in the first place; they would build it out as an extension of the cantilevers, and have a joint in the middle so arranged that in a very short time they could connect it there, and at the same time disconnect it at the ends to allow the movement for expansion and contraction. He did not know whether the members had had an opportunity of seeing the paper read before the American Society of Civil Engineers upon the Niagara cantilever bridge, which was practically the outcome of the design of the Forth Bridge. The Niagara Bridge was finished long before the Forth Bridge, but the design had not been settled until that of the Forth had been arranged. There was a long discussion upon the subject, and it was laughable to observe the way in which the American engineers spoke of steel. They seemed to think that a piece of steel might be soft in one corner, hard in another, and that, if it was looked at, it might go all to pieces. The great value of steel did not consist in its hardness, but in its homogeneity. Another great thing about it was its extreme ductility. Long before it gave way it would give ample notice, which no other metal would do.

The analyses made in the course of manufacture of the steel show that the proportions of the different principal components are generally as follows:

	67,000 to 74,000 lbs. per sq. in.	76,000 to 83,000 lbs. per sq. in.
Iron.	Per cent. Difference.	Per cent. Difference.
Carbon	.19	.23
Silicon	.02	.03
Sulphur	.024	.024
Phosphorus	.046	.046
Manganese	.69	.69

The President said that the members might be glad to hear some remarks from Captain Jones, of the Edgar Thomson Steel Works, Pittsburgh.

Captain Jones said that four years ago he took a firm stand in America on the subject of punching, which he regarded as a relic of barbarism. In the construction of a roof over the Cambria Iron Works 15 years ago he drilled all the members, and established the fact conclusively that drilling was the cheaper of the two methods.

In regard to the steel used in the United States, the boilermakers and bridge constructors lacked one great point in starting. They ought to decide on the chemical composition required, and then all persons would bid on equal terms; but where the physical properties alone were specified, each maker would put in the cheapest steel to meet that specification, and the general result was that much of the steel that entered into the construction of bridges in America had no business there. In the Edgar Thomson Steel Works their specifications for boilers were far more rigid than those of the United States government for the boilers for their cruisers. They limited the phosphorus to 0.035, and the manganese to 0.025. When the specifications were given out, the steel makers refused to conform to them; but he insisted on them, and carried the day. He then specified that no holes were to be punched. He knew from his own personal knowledge that proper care had not been taken in the manufacture of steel. He had seen steel made for big structures where the heat was blown very rapidly—probably in eight minutes—and the ferro-manganese put in cold, and he did not think that the reaction in that steel had taken place yet. On his assuming the charge of the Homestead Steel Works, a radical change had been made, and he thought Mr. Clarke would testify that the steel he had received from those works in the present year was of a very high class. He was sorry that he had not got particulars of the large series of tests made, showing that the steel was homogeneous and remarkably even in its results.

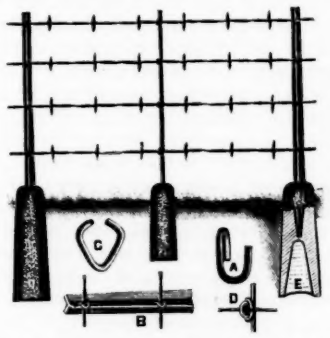
He fully coincided with the observation of the President. If he possessed dictatorial powers he would enact that no member of a bridge construction should have an excess of 0.65 in phosphorus. He would keep the manganese as low as possible, as it was a great oxidizing agent, particularly in boilers.

The President said he congratulated his American friends on having generally come to the conclusion that drilling was preferable to punching. He regarded it as a compliment to himself. Under his patent of 1861-62 he did not receive a sixpence in the way of royalty during fourteen years, and hard things were said about the man who dared to abandon the punch and adopt the drill for perforating plates. He was exceedingly pleased to hear Mr. Cooper's report as to the advantages of drilling, and its superiority to punching in point of cheapness.

Mr. Riley said he should not like it to go forth to the public that the institute endorsed the view expressed by Captain Jones. He held very strongly that it was not the function of the engineer to state what the composition of steel should be. He might fix the physical properties as he pleased, but to say to the manufacturer, "You shall make steel to stand such and such tests, and make it of such and such a composition, and in such and such a way," was utterly outrageous. The composition of the steel was essentially the province of the metallurgist or steelmaker. The engineer might insist on any physical tests he liked, but he should not dictate how the material should be made.

The Eon Fence Post.

The accompanying illustration shows a metal fence post especially designed for railway use. The post, above ground, is an iron or steel bar of section as shown by fig. B. The base or underground portion is of asphaltic concrete, pressed on to the base of the bar, while in a heated condition, by a machine invented for the purpose. *A* represents the stay for fastening the fence wire to the post; *B* the shape of



metal bar (and *A* applied); *C* is the device for holding the wires in the loops of the stay; *D* shows how *C* is used; *E* represents a cavity in the base. The inventor claims that the base is absolutely moisture proof, so that frost or water cannot affect it. He also claims that in first cost this post is less expensive than wood, while it is much more durable. Information may be had from the inventor, Mr. C. S. Long, Aurora, Ill.

Major Powell on the Erosive Power of Rivers.

In reply to a letter from the New Orleans Chamber of Commerce asking him what the effect of the proposed system of reservoirs on the headwaters of its affluents would be on the commercial and agricultural interests of the lower Mississippi, the director of the United States Geological Survey replies at some length, reciting the fact that the Mississippi, draining about 1,250,000 square miles, discharges past New Orleans an average of 675,000 cubic feet per second, most of which is derived from the following streams:

	Cu. ft. per sec
Upper Mississippi	100,000
Missouri	120,000
Ohio	160,000
St. Francis	20,000
Arkansas and White	60,000
Yazoo	40,000
Red	60,000

The sediment carried past New Orleans varies from $\frac{1}{400}$ to $\frac{1}{2000}$ of the volume, and averages about $\frac{1}{2000}$. The Upper Mississippi, above the mouth of the Missouri, carries from $\frac{1}{800}$ to $\frac{1}{100000}$, with an average of $\frac{1}{4500}$ part of its volume, and the Missouri, just above its confluence with the Mississippi, is charged with from $\frac{1}{200}$ to $\frac{1}{5000}$, and an average of $\frac{1}{700}$ of its volume. This amounts to an average discharge of sediment, in round numbers, of 170 cu. ft. per second, or 500,000 cu. yards per day. "At flood-stage the discharge of sediment has been observed to be as great as 4,000,000 cu. yards per day."

Major Powells' theory is that "the cutting power of a stream increases rapidly with the increase of sedimentary load," and gives the following reasons for the theory:

"When a river receives from a tributary a disproportionately great load of sediment, such sediment is soon deposited, and the channel is thereby choked. This choking is of a peculiar nature; for the sediment is not deposited evenly along the bottom of the channel, but is thrown down in the quiet waters, that is, it is deposited irregularly along the course of the stream, now on one side and now on the other. These irregular deposits turn the current of the stream and throw it against the banks, now on one side and now on the other. By this agency the banks are cut, and the waters of the river are again loaded with sediment, which is again thrown down, and again the stream is turned against its banks and again loaded, and again deposits are made. It is thus that the original overload of sediment is made the occasion for a series of operations, each one of which serves to choke the channel in such a manner that the floods are thrown out upon the adjacent land. As long as a stream running through a flood-plain is overloaded with sediment, just so long will it choke its channel, and just so long will it change the position of its channel, and just so long will it inundate the adjacent lands of the flood-plain at the time of flood."

It has been held on the other hand that while the Mississippi is in flood the *bottom* of the river is materially raised, as well as its flood line. And it is also held that as the water falls, the water soaked banks, losing the supporting power of the water, cave faster than on the rise or during the flood. The deposits spoken of are undoubtedly formed, and as the river falls it cuts its channel through them, not always as rapidly as the river goes down. Major Powell cites the fact that the reaches between the Ohio and the Atchafalaya, where the percentage of sediment is greatest, is the region of the greatest lateral erosion or bank cutting.

He states that the real problem is to relieve the river of the excess of sediment derived from the bad lands and sand plains bordering the Missouri, and that the storage of the flood waters of the Missouri and other tributaries which are surcharged with sediment would permit the purer waters to open a sufficient channel for themselves, thus lowering the flood line in the Mississippi valley, and at the same time spreading these redundant waters in the valleys of the Rocky Mountains and over the arid plains at their base. "The two problems are inseparably joined. Irrigate the deserts and make them gardens and wheat fields, and by the same process you protect the flood plains of the Mississippi and make corn fields and cotton fields." But it is not held that this will entirely dispense with the necessity for training walls and bank protection.

It is said that about 150,000 square miles can be irrigated from the Rocky Mountains. This is nearly twice the area of cultivated land in the United Kingdom of Great Britain and Ireland.

TECHNICAL.

Colorado Oil.

At the Cleveland meeting of the American Association for the Advancement of Science, Prof. J. S. Newberry said of the "Oil Field of Colorado," which is in the Arkansas Valley about the town of Florence, that it is in the middle cretaceous. About 20 wells have been bored from 1,100 to 1,600 ft. deep; some fourteen of these wells yield, by pumping, from 800 to 1,000 barrels per day of a greenish colored, excellent oil, which contains 40 per cent. of good kerosene and 60 per cent. of a superior lubricating oil having more paraffine in it than the Pennsylvania oils. The source of this oil is, as the professor thinks, the carbonaceous matter of a Colorado black shale from which it is being spontaneously distilled.

This field is extensive and the yeld of oil may apparently bn increased indefinitely. There are no great "gushers" in the field, but the average yield is stated to be greater than that of the Pennsylvania wells.

Parsons' Train Indicator.

This device for showing the number of the train in the front and rear windows of the cupola of the caboose, where it will be visible to both front and rear, either day or night, which has been used on the Lake Shore & Michigan Southern for several years, is now in use on over 20 different roads, among which are the Chicago, Rock Island & Pacific; Wabash Western; Chicago & Northwestern; Chicago, St. Paul, Minneapolis & Omaha; Grand Trunk; Chicago, New Orleans & Texas Pacific; Western New York & Pennsylvania; Minneapolis & St. Louis; Chicago & Eastern Illinois, and Boston & Maine. It is also being tried on the Santa Fe system. Mr. Parsons has lately patented a combined tail light and indicator. This device is designed to furnish a light which will comply with all the conditions of the rules of the uniform code, and provide a simple combined light and number indicator.

Fatal Blasting Accident.

Nine men were killed and six others seriously injured on Sept. 11 by the explosion of a blast in the Montana Central tunnel, near Helena, M. T. The tunnel is being driven from both ends, and for the last ten days workmen on each side have heard each other's movements. The gang in one end is composed of Irishmen and in the other end of Swedes. There has been greatrivalry between the two gangs to see which would make the hole first.

On the night of Sept. 10 orders were given by the contractors to be careful and put in small blasts. Just before the night shift of Swedes quit they put in three big blasts. Orders had been previously given to drill only 10 ft., but the Swedes drilled 20 ft. As the hole was nearly through the Irishmen, not knowing the Swedes had drilled so far, exploded a single cap over one of these holes, which exploded it and set off the other two blasts. Three hundred pounds of giant powder stored in the vicinity was also exploded, and the result was awful. As soon as the smoke cleared away rescuers entered the tunnel and found the remains of nine men scattered all over the place, one man being cut completely in two. The tunnel is 6,000 ft. long, through granite, and this is the first accident.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The Roadmasters, in their Washington convention just ended, spent far more time in the discussion of the question of joints than in that of any other subject which came before them. Yet, the only action taken was to refer the matter back to the committee, for report another year. Had the question been pushed to a vote it is highly probable that the three-tie supported joint would have been adopted. At least the weight of discussion tended very strongly that way. After a long discussion, however, the members concluded that they did not yet know enough about joints to take any definite action, and decided to take more time for observation. In the next year not many of them will have a chance to do what they are required to do by the resolution putting the subject over to next year; that is, put in joints of both forms for comparison under like conditions. Many of them will, however, have opportunity to see more or less of the latest forms of heavy angle-bar joint suspended, and of the three-tie supported joint, and their attention has been so sharply called to the matter by the discussion this year that they will undoubtedly watch the action of both with more care than ever before. The difference of opinion was so great that any action taken now could not have been of much weight.

While this convention was not very fruitful in recommendations, a good many hours were consumed in discussions which will have their results in time. The attendance at all of the sessions was large and many different members took part in the discussions. The attendance was the largest in the history of the organization. The scruples which many roads have felt about giving free transportation to the members of the Association to and from their place of meeting caused some trouble to the officers of the Association, and to some degree, no doubt, diminished the attendance. As the good results of these meetings become more apparent, managers will probably be able to more clearly see that no more legitimate use can be made of passes than in the promotion of such conferences. If the exceptions embodied in the Inter-state Commerce law mean anything, they mean that railroad men traveling in the interests of their employers are not required to pay fare.

The Superintendents' Association meets at the Southern Hotel, St. Louis, on Wednesday next. The membership of this association is largely in the West, and it is well to have a meeting there, notwithstanding the greater ease with which men can be induced to come to New York. Eastern superintendents should visit the roads beyond Chicago oftener than they do.

The prime object of this association, like all others of its class, is to get and give information; but its members no doubt will agree that it just now has a special duty, that of developing its enthusiasm for the objects it purports to exist for. The Time Convention is an official body; the Superintendents' Association is wholly unofficial, and its usefulness in securing co-operation between these two and with other railroad associations depends largely on the assurance that shall be given by its deliberations that it is useful. The superintendent and general manager are often identical. Some road masters, car-builders, and other members of sister societies are not amenable to a superintendent, and, therefore, do not look up to a superintendents' association as to a superior. But, notwithstanding this, there is now some disposition to make the most of all these deliberative organizations, and to arrange their respective fields so that they can work in harmony; and it is to be hoped that all will go to the meeting with the disposition to give lively expression to whatever views they may have, and not to merely absorb wisdom from others. For the time being the idea of getting information should be placed in the background and an effort made by every one to give out something. If each member resolves to give to the meeting a single practical idea there will be no trouble about getting enough new ones to carry home. Whatever the relation between the Time Convention and the superintendents, there can be no harm in regarding the smaller organization as a "committee of the whole" to consider any and all subjects. The reception which is likely to be given to the reports of this "committee" need not be the cause of anxious speculation. The specific subjects appropriate to be discussed by the superintendents are not easily stated in brief space, as the superintendent's profession includes an infinite variety; but there are two prominent topics which ought to be brought up at this meeting, for the reason that they are now engaging the attention of some of the most progressive superintendents. One is train dispatching, and the other is the examination of train and station men on train rules. The general adoption of the uniform code has been attended by marked improvement in both these lines. The need of having a high class of men for dispatchers is felt more than ever before. The employment of a block system, or at least of the principles embodied in that system, is receiving careful attention, and trains are now kept one station apart by telegraph—either through the independent action of the station operator or under the supervision of the dispatcher—on a number of prominent roads. Examinations of men for the purpose of making sure that they know their instructions (as distinguished from the common fashion of merely making sure that they have seen a paper on which the instructions are printed) have been instituted during the past year on a number of large roads. The art of questioning in this department is, however, yet poorly understood, and it should be a subject for discussion.

The argument of the complainants in the matter of car-load rates has recently been made public. It presents several features of interest. We note with satisfaction in the first place, the increased knowledge of principles of railroad economy on the part of the shippers. Counsel disclaim, almost with indignation, the intention to attack car-load rates on such articles as coal, grain or lumber, "the normal unit of shipment of which is beyond controversy the car-load." Thus far, they put the question on what seems to us precisely the true basis. The Inter-state Commerce law attempted to place through and local traffic on an equality. But the through traffic was more economical for the railroads, and they therefore arranged a classification system which, especially by its car-load rates, gave a relative advantage to the business of large trade centres. Could they be allowed to defeat the purpose of the act in this way? Complainants contend that they could not. This is a fair question for argument; but we are disposed on the whole to take a different view of the matter from that which is advocated in their brief. A large part of the detailed argument of the complainants is based upon the definitions of "substantially similar circumstances and conditions" given in the Louisville & Nashville case. But the Louisville & Nashville case dealt with an explicit prohibition of differences of charge between different localities under substantially similar circumstances and conditions. The difference in this case is between different forms of traffic. The fact that its incidental effect is to alter the relation between different localities does not, therefore, bring it under the short-haul clause. It must be argued as a question of unreasonable preference. Looking at it in that light, we cannot regard it as wrong for a railroad to adopt a system of rates which gives a general advantage to the more economical form of traffic, even though this may produce unfair results in particular cases. It is on such general grounds, rather than for its effect on individual cases, that any system of railroad charges must be attacked or defended. We, of course, do not deny that the difference between car-load and less than car-load rates may in some instances be so great as to produce general as well as special injustice; but we are speaking of the general position of the complainants, in its wider bearings upon railroad law and railroad economy.

A press dispatch says that the Railroad Commissioner of Ohio has examined the trestles of one of the narrow-gauge roads of that state, and has found them in such poor condition that he has ordered the company to restrict the speed of all trains on these bridges to 6 miles per hour. We have efficient commissions in a number of states, but we seldom hear of an order of this kind, although there is little doubt that trestle bridges over which trains should be run only with great care exist on railroads in nearly every state in the Union. The query arises whether the road which is subjected to this Ohio order will pay as little respect to it as many roads do to their own orders, issued in the same line. Locomotive runners must exercise their individual judgment in a variety of circumstances, and their interpretations of the precise meaning of an order or the most practical way of carrying it out vary greatly. "Six miles per hour" often appears on the signal post at bridges which are passed at speeds varying from 3 miles per hour up to 10 or perhaps 15. It will be remembered that the recent serious wreck of a passenger train at Orange Court House, Va., occurred when the train was running, according to the accounts, within the required limit of speed (6 miles per hour). Probably the Ohio Commissioner, although he has pursued a more vigorous course than most commissioners do, should have gone still farther, and ordered an entire suspension of traffic over the shaky bridges examined by him. A bridge which will not endure a speed of more than 6 miles an hour surely has too low a factor of safety, and no passenger train should be allowed upon it.

The Commissioner's action, whether it be sufficiently radical or not, is encouraging, for there is much need of quickened thought on this subject. Not that railroad officers do not realize to a certain degree the poor condition of their bridges or that they are disposed to run passenger trains at a reckless rate of speed over them; but that more definite and vigorous action should be taken in many cases and a general feeling of unrest cultivated, to the end of securing more frequent inspection and repair and a strict observance of speed limits. Hundreds of bridges that should be renewed, but cannot be, have to be used with great care, but that there is a proper understanding, by all concerned, of the degree of caution necessary, and a proper supervision by the superintendent of the scores or hundreds of men who must use these bridges, exercising their own individual judgments as to speeds degree of strength, is not at all certain. One of the severest reports of the British Government accident inspectors last year was a stricture upon a road which had made a reasonable speed limit at several critical points, and then straightway made a time-table which necessitated its constant violation; in fact the road virtually ordered the runners to violate it. American superintendents could tell of similar practice—by their neighbors.

The Future of Traffic Associations.

For many years past there have been frequent predictions of the downfall of the pooling system, and all that was connected with it. Such predictions have always been popular. The majority of people, knowing little or nothing of pools, object to them on general principles. The majority of those who do know anything about the matter usually grumble at nearly every feature of the system which may happen to be in existence at the time. There is only a minority of a minority which cares to defend it from criticism, or wishes to disbelieve the prophecies of evil.

Just at present the prophets have more facts than usual on their side. Mr. Blanchard has resigned his commissionership in the Central Traffic Association; and, to all appearances, he seems to wish sincerely that his resignation may be accepted. Mr. Fink is pursuing a policy of masterly inactivity at Carlsbad. Mr. Pierson finds it increasingly difficult to keep matters under his control. The emigrant pool—until recently the most effective railroad combination which we have seen—is now as badly embroiled as its worst enemy could wish. Leading trunk line authorities are heard complaining that the whole association, as at present conducted, is hardly worth the money which it costs.

And yet we have our doubts as to whether the prophets are right. Somehow or other, the pooling system continues, under various modified forms, in spite of complaints and of wars, in spite of newspapers and legislators. However hard it may be to keep up

an effective combination, it is still harder to get along without one. However stringent the laws intended to prevent combination, the necessities of business are still more stringent. There are two facts which constantly force themselves upon our notice: first, that railroads cannot well get along without traffic associations; and second, that traffic associations cannot well get along without something in the nature of pools.

The first of these points is so obvious as hardly to need proof. With business arrangements as complicated as they are to-day, the attempt to manage roads without concerted action would involve most serious inconvenience to the public as well as bad economy for the railroads. In the annual report of the Inter-state Commerce Commission the necessity for traffic associations is emphasized in the strongest terms. The Commissioners say that such arrangments are necessary in order to make the railroads of the greatest possible service to the community. Joint classification and tariffs, harmonious interchange of traffic, methods of continuous shipment, depend upon the existence of such association for their smooth working, if not for their very existence.

Can such associations be effectively maintained without the power to divide traffic? Experience indicates that they cannot; and it is this fact quite as much as any other which makes it hard to prohibit pools.

The joint working of independent lines involves agreements as to rates. Where there is actual competition it is almost impossible to enforce any such agreements. Even when the principals intend to carry them out in good faith, their agents often do not. A few instances of rate cutting cause mutual distrust, and the association loses half its value simply because all real harmony of feeling has departed. A pool or division of traffic, on the other hand, though not always easy to carry out, has the advantage of making the rate agreement effective, and of removing much of the suspicion of bad faith.

So obvious is the necessity of maintaining rates if traffic associations are to have any force, that men like Simon Sterne, in excusing the pooling clause of the Inter-state Commerce act, by no means denied the advantages of pools in times past. Mr. Sterne said in substance that if rates could only be maintained by pools, pools had a sound reason for their existence; but that the Inter-state Commerce law, in providing safeguards for the maintenance of rates, deprived pools of that excuse. Now any one who has watched the recent rate wars in the West can see how ineffective is the control which the present law gives against irresponsible reductions in rates. There was a short time when it was effective in this respect; but to-day the law gives one railroad no protection against the irresponsible acts of its competitor. It prohibits pools and offers no real safeguard to take their place.

It is under this state of things that the railroads are now suffering. The Trunk Line Pool, which was in fairly good operation before the passage of the act, had to be discontinued. Other pools kept their operations as much as possible in the shade. As long as rates were well maintained, no one was much the wiser for this state of things. But now that rate wars have begun, our roads feel the absence of any means of self-defense. The present state of things is not satisfactory to any one. The absence of all arrangements between independent lines would cause grave public inconvenience. The only satisfactory alternative would seem to be to adopt some measures to strengthen the existing associations, and make it possible for them to do something effective.

But can this be done without violation of the law? Apparently it can. The granting of a differential to a line which is losing traffic at uniform rates, practically amounts to the same thing as a percentage division. There is no law which makes it illegal for a line to increase its rates when it is getting more traffic than its rivals. True, there is no way to compel it to do so; but there was no way to compel it to adhere to an old-fashioned pooling contract. In this respect we are no worse off than before. In fact, the best organized and most effective of the old pools—that of the Southern Railway and Steamship Association—was for the most part managed by variations in rates rather than by direct diversion of traffic. If a Southern road carried more than the agreed percentage, it was given an insufficient allowance for operating expenses; in consequence of which it was good policy for such a road to stiffen its rates and let traffic go on to other lines. With slight modifications such a system could be so arranged as not to come in conflict the letter of the Inter-state Commerce act.

Such a course would awaken oppositions; but we doubt whether it would be successfully resisted. A recent decision of Lord Coleridge in the case of a steampship association, or "conference," as it is called in England, goes far to give such arrangements a good standing under common law. The danger of an effective United States Statute against it is not very great. People are willing to let the Inter-state Commerce law alone for the present. The Inter-state Commerce Commission, so far from being hostile to traffic associations, is disposed to stretch a point in their favor. The public at present fears manufacturers' trusts much more than railroad pools. Above all, the experience of 1884 and 1885 is so fresh that few people wish to encourage a reckless war of rates. If really brought face to face with the alternative between a reckless war and a modified pool, many of those who complain loudly of present arrangements would hesitate to choose the former. We may have to go through some hard experiences before people realize how matters actually stand, but when they once face the situation, we believe that they will accept the alternative of strengthening traffic associations rather than of making them ineffective.

Railroad Earnings in 1887.

The remarkably good general showing made by our railroads in Poor's Manual for 1888 must not blind us to one or two less favorable symptoms. While the increase in gross earnings was large, the increase in net earnings was much smaller, and the change in net earnings per mile operated was a mere trifle—only $68. How little this amounts to is seen by comparing the figures for a few years past.

Net earnings per mile operated:

1882	$2,670
1883	2,702
1884	2,318
1885	2,185
1886	2,376
1887	2,444

The average of the figures for the five years, 1882 to 1886 inclusive, is $2,450. In other words, the net earnings per mile of road operated in the year 1887 were a trifle less than the average for five years previous. When we remember what those five years were, we may well hesitate before congratulating ourselves too unreservedly on the results of the year 1887.

When we confine our comparison to the two years 1886 and 1887, there are several circumstances which make the failure to increase net earnings all the more noticeable. Not merely was the volume of traffic in 1887 larger, but its density also; that is, the traffic was greater in proportion to the mileage. While the length of line operated had increased a little less than 10 per cent., passenger movement had increased a little more than that figure, while freight movement had increased 17½ per cent. In spite of rapid extension the average density of traffic was thus decidedly greater. It was also carried at higher average rates. Passenger-mile charges had increased from 2.181 cents to 2.276 cents; ton-mile charges from 1.042 cents to 1.063 cents. How was it that under these circumstances the percentage of operating expenses and earnings increased instead of diminished? Gross earnings for 1886, as given on p. ii. of Poor's Manual, were, in round numbers, $830,000,000; operating expenses, $529,000,000. In 1887 the respective figures were $940,000 of earnings and $605,000,000 of expenses. The percentage of expense in 1886 was 63.7, in 1887 it was 64.4. Under any circumstances this change would have been a noticeable one, but with increasing traffic and rates it is specially remarkable and demands detailed explanation.

There are two main reasons for it, one of which is favorable to the railroads, while the other is not. The first—and we may hope the most important—reason is the adoption by our companies of a more conservative policy in estimating net earnings. They charge many things as repairs to-day which a few years ago would have been simply added to capital account. In our article on the Pennsylvania company's business, a few weeks ago, we gave many illustrations of this policy. We cannot apply the same analysis to Poor's figures, because they are not sufficiently classified. We have no means of telling how far the increased percentage of operating expense is due to change in the method of estimating repairs, because the different items of expense are not separated in the tables before us. This cause will probably explain much; but it is by no means the whole explanation.

The other cause, or rather group of causes, is connected with traffic economy. As long as a railroad increases its train loads, and does not diminish its average length of haul, it can bear decided reductions in rates; but if anything occurs to check this process, the evil effects are at once apparent. Something of this kind has actually happened. For four or five years ending in 1886, length of haul remained about the same, while train loads increased rapidly; in 1887 the increase of train-load was relatively slight in proportion to the new traffic developed, while the length of haul actually diminished for both freight and passenger.

In 1883 the freight train mileage was 350,000,000; the ton-mileage 44,000,000,000. In 1886 the freight train mileage, even if we include mixed trains, had only increased to 359,000,000, while the ton-mileage was little short of 53,000,000,000. In 1887, freight and mixed train mileage had increased to 405,000,000, while ton mileage had become 62,000,000,000. Comparing these two periods with one another, we find that from 1883 to 1886, volume of freight traffic had increased 20 per cent., with an increase in train mileage of little over 2½ per cent.; while the change from 1886 to 1887 involved an increase of traffic of 17 per cent., with an increase in train mileage of 13 per cent. The great development of traffic in 1887 has been by no means accompanied with a corresponding development in traffic economy.

In one respect there has been a decided loss in economy since 1884. The length of haul is shorter. It is impossible to say how great is the change in this respect, because the apparent length of haul given in the statistics depends more upon methods of reporting than anything else. If two separate administrations handle a ton of freight for 50 miles each, it appears as *two* tons and 100 ton-miles; average haul, 50. If the administrations consolidate, it appears as *one* ton and 100 ton-miles; length of haul, 100. Increasing consolidation tends to make the apparent length of haul greater. If, in spite of this tendency, the apparent length of haul lessens from year to year, we may conclude that a change is going on more decided than the figures would indicate. In other words, that the new traffic is mostly short distance traffic.

The greater relative development of short distance traffic is due to a combination of causes—changed conditions of foreign trade, increasing density of settlement, state and congressional legislation. This is not the place to trace the relative importance of these various elements. It is clear that their final effect must be to increase local rather than through business. This change goes far to explain the combination of higher average rates with larger percentage of operating expenses; it explains still more fully why increased traffic does not necessarily produce better train economy.

That this change is, in the long run, a healthful one, both for the railroads and the general business interests of the country, we fully believe. But we also believe that it has its bad as well as its good effects on railroad economy; and that a merely superficial study of the returns would lead to rather too favorable conclusions. The enormous expansion of traffic is an obvious fact, as well as an important one. The failure to increase net earnings per mile above the average of the last five years is less obvious but equally important. Both sets of facts must be looked at together.

Adhesion Weight.

The great weight on the drivers of some recently built passenger locomotives is a subject to which attention has been repeatedly drawn in these colums; but at the risk of indulging in some repetition, it may be permissible to again draw attention to the fact that great weights placed on the drivers of fast running engines tend to strain and damage the permanent way. On many lines where these fast and heavy engines are running the rails not recently renewed were somewhat light when originally laid down, and their weight and strength have been considerably reduced by wear and corrosion. Furthermore, many of the rails laid some years ago were manufactured very hastily, often from indifferent ores, and the consequent presence of an undue quantity of phosphorus renders them brittle, and the danger is not decreased by the fact that such steel is often high in carbon and of uneven quality. It may be argued that in some cases, such rails have lasted well and have carried a very heavy traffic, but it is possible that the loads hitherto imposed have been within the elastic limit and that the additional weight now placed upon them may pass this limit, especially when applied when the rail is nearly worn out and its section considerably diminished and weakened. On the other hand, apart from the rails, rotten ties and loose spikes will be found at intervals even on well maintained roads, and fast trains have been wrecked before now by one rotten tie and even by one nut being missing on a splice bar bolt. The fact that a weight of nearly

40,000 lbs. on a pair of wheels running at 50 miles per hour must throw a severe strain on permanent way in good order is self evident, and as a defect at only one point in a long run may prove disastrous, it is obviously prudent to so proportion the load that it can pass safely over a defective splice bar or a badly tamped or half rotten tie.

The question further arises whether the great adhesion weights now used are absolutely necessary, and the fact that very heavy passenger trains are now drawn at a fair rate of speed on the Old Colony, New York Central, Lake Shore, and many other roads seems to show that it is possible to run the heavy cars now in use with engines having at the most about 65,000 lbs. on the drivers.

A committee of the Master Mechanics' Association recommended in 1887 a rule for the amount of adhesion weight in relation to the cylinder power and boiler pressure. This rule, as regards passenger locomotives, gives what is a fair average of practice all over the world. The highest calculated adhesions for American type engines were for the Lake Shore and Old Colony engines, which carry very high boiler pressures, 180 and 175 lbs. per square inch, respectively. According to the rule which allows that the highest average pressure on the pistons is 85 per cent. of the boiler pressure, the adhesion weights should be 70,500 lbs. and 68,200 lbs. respectively. These engines are, however, running very successfully with weights of from 64,000 lbs. to 61,700 lbs. upon the four drivers. These weights are, therefore, sufficient for the most powerful American type engines running in 1887, taking the boiler pressure into account as well as the diameter and stroke of the cylinders and the diameter of the drivers. If these weights are sufficient for adhesion, what is gained by placing 80,000 lbs. upon the four drivers of engines of less tractive power?

The weight of modern fast trains seldom exceeds 700,000 lbs., including engine and tender, and when ascending a grade of 50 ft. per mile, the gross resistance is probably below 10,000 lbs. A weight of 60,000 lbs. on the drivers would therefore allow a coefficient of $\frac{1}{6}$, which certainly appears ample, especially if a good supply of sand is available. Improved methods of delivering sand on the rails have been experimented with in this country and have been largely used elsewhere, and it seems that some method of gaining sufficient adhesion without any excessive weight is well worth the trial.

A heavy engine implies a durable engine, if the weight is properly employed in strengthening the working parts, enlarging the bearing and rubbing surfaces, and increasing the heating surface and strength of the boiler. In some cases, however, much of the extra weight contributes nothing to increase the durability or steaming power of the engine. Heavy cast-iron foot-plates, cab-stands and ash-pans simply increase the adhesion weight of the engine and fulfill no other useful purpose. It may well be contended that in many cases this excessive weight is not only unnecessary but mischievous, and that the weight not only renders the engine destructive to the permanent way but is an additional load which the engine always has to draw. An unnecessary weight of 5 tons on an engine hauling a 350-ton train represents nearly 1½ per cent. additional power required; and, strictly speaking, the weight of the engine and tender has to be increased that amount, 1½ per cent., to enable it to generate power and carry sufficient fuel and water to haul the additional load. This amount on a heavy passenger engine and tender in itself amounts to about one ton. Thus weight begets weight, and an unnecessary weight involves additional weight to haul it.

Speed of Passenger Trains.

A table on another page gives particulars of the train service between New York, Philadelphia and Boston and the principal summer resorts. It will be seen that the speed, with few exceptions, is below that between the principal cities, as shown in a recent issue.* This is not surprising, as the majority of the roads to summer resorts have little traffic during at least nine months in the year, and it is therefore commercially impossible to provide the excellent roadbed and equipment which alone render high speed safe or even practicable. The lines running to the mountains have necessarily heavy grades, which also tend to prevent the attainment of high speed. In many cases, however, the speeds attained under favorable conditions are low, while in others quick time is made in spite of many obvious disadvantages. The skill and enterprise shown by the management of the Pennsylvania are well exemplified by comparing the speeds obtained between Philadelphia and seaside resorts with those of similar trains running from Boston and New York. Both the maximum and the average speed is higher between Philadelphia and Long Branch than between New York and Long Branch. The average speed of all the Philadelphia trains given is 33.16 miles per hour, which is faster than that of the fastest summer train running from Boston, with the sole exception of the Limited Bar Harbor express. The average speed of the Philadelphia trains exceeds that of the Saratoga trains on the New York Central by nearly six miles per hour. The New York Central route has no ferries, and has, moreover, the great advantage of a track which is earning money all the year round and is not practically abandoned during the winter months. It can therefore be maintained in first-rate condition. Under these circumstances, it is somewhat surprising that the average speed of the Saratoga service is so low, especially as the service to Buffalo and beyond shows a good average speed.

Comparing the fastest trains between New York and Saratoga, and Philadelphia and Cape May, and Atlantic City, the table shows that between the latter points, in spite of the ferry across the Delaware, the speed attained equals that of the Saturday special on the New York Central, while both surpass the Bar Harbor express on the Boston & Maine. It is very fortunate for the inhabitants of Philadelphia that they have such a quick service of trains, for with slower speeds Philadelphia is put too far from the sea to render it possible for a business to travel up and down every day.

The train to the Adirondacks maintains a very good speed, when the rugged nature of much of the country traversed is taken into account, and rivals the speed to Richfield Springs, where the greater relative length of level and well-kept main line are more favorable to fast running.

* A table giving the speed and number of trains daily between the principal cities appears on page 536 of the *Railroad Gazette*, Aug. 24, 1888.

The Harbors and Waterways Bill.

The Cullom-Breckenridge bill to create a bureau of harbors and waterways is on the Senate calendar, and a favorable report is hoped for from the House Committee. The Chief of Engineers (General Duane, since retired) made an unfavorable report on the bill, and in forwarding the report to the Chairman of the Senate Committee, the Secretary of War indorses it, and states that in his opinion the bill should not be passed.

The objections made by General Duane are: (1) The personnel of the corps cannot be improved in efficiency, as it is now made up of the best of the young men who graduate from West Point. These men then spend three years at the School of Application at Willet's Point, and later serve for five or six years as assistants on actual work.

(2) The present system is more economical in the matter of pay of engineers than that proposed. The work is now conducted by about 40 army officers, whose pay would go on in any event, and by about 100 civil assistants, whose pay is about $200,000 per annum. This ceases if there are no appropriations. The proposed corps would have a pay roll of $1,180,000, and eventually a paid retired list.

(3) The proposed method of making appropriations would "be of undoubted benefit to a few works to the exclusion of the great mass of them, or otherwise the river and harbor bills will exceed the proportions of reasonable limits. It is exceedingly questionable whether the interests of the country at large would be promoted by a change which would require the suspension of operations upon most of the works now in progress and permit them to deteriorate and decay while a few were advanced to completion at a somewhat less cost."

The President of the "Council of Engineering Societies, etc.," has addressed to Senator Cullom a long reply to this report, which we will not reproduce; but to those who are at all familiar with the discussion of the subject, the reply is obvious enough. Indeed, the report made by General Duane is so little calculated to convince any one, that it must be regarded as a merely perfunctory document, written simply to state officially that the Chief of Engineers was opposed to the bill.

The argument made by the late Chief of Engineers as to the relative efficiency for river and harbor work of the present corps of engineers, and the proposed civil corps, we will not discuss at any length. Any one can see the objections to an examination into specific cases of success or failure of engineering works under civil or military administration. Every candid man will concede that there are able specialists in the corps of engineers, and that the public works under their charge are carried on with wonderful freedom from any dishonest use of the money expended. But it is fair to concede also that equally honest and able men will be found to carry on the work under a proper civil organization. It is hardly supposable that any one would seriously claim that the West Point course in civil engineering is likely to turn out as high an average product as that of any one of half a dozen or more technical schools which could be mentioned. Of the few men who, on leaving West Point, go into the engineers, a number are afterwards trained for public works service at the Willet's Point School of Application, and by "duty as assistants to officers of rank having charge of important works."* It is proposed by the Cullom-Breckenridge bill to recruit the corps of public works engineers not only from the existing corps, but from that far greater number of men who have been graduated from all the engineering schools of the country, and whose subsequent training has been in the actual practice of the profession in which they expect to get their living, and win such distinction as they may. It must be borne in mind that in the case of civilians this post-graduate training comes, not in the performance of duties arbitrarily assigned to them, but in the pursuit of a career which they have voluntarily chosen. Which of the two methods of securing men to carry on the river and harbor works is most likely to bring to the work the highest professional skill and character can hardly be a matter of doubt.

In considering the relative cost of the present system and of that proposed the late Chief of Engineers compares an establishment of 60 officers of Engineers, whose pay is not chargeable to the civil works, and 100 civilians drawing $200,000 per annum, with an establishment of 615 officers with pay of $1,180,000. Obviously such a comparison is worthless, and we will not follow Mr. Cooley in the analysis in which he shows how misleading it is. With a given amount of work to do the cost for engineering and supervision would not greatly vary under either system, and is of small consequence as compared with getting an efficient service and a rational scheme of government civil works. It should be borne in mind, however, that the bill provides for temporary retirement on half pay of the members of the civil corps is case the appropriations are insufficient, and that it is made the duty of the Secretary of War to limit the number of appointments to the requirements of the service.

The third objection to the Cullom-Breckenridge bill which is raised by the late Chief of Engineers is to that provision of it which we have always thought the most valuable and the one promising the greatest public good. The bill requires that appropriations shall be made only after plans for work are properly considered and matured, and that no expenditures on any one work shall be made until enough money is in sight to complete that work, or to produce an adequately useful result. This part of the bill is expressly designed to prevent expenditure "when the amount applicable to a work is insufficient to serve any useful public purpose in connection with benefits to commerce, or the completion of the work." It is this provision of the bill that is expected to do away with merely political appropriations; and it is greatly to the credit of the army engineers that it is they who have most persistently pointed out the wastefulness of appropriations so subdivided as to be insufficient to complete any one work. It is hard to understand how any well-informed and public spirited man could wish to perpetuate the present way of making the appropriations, whatever may be his opinion as to the organization of the corps which is to expend them.

Wind Strains on the Forth Bridge.

An interesting paper on the Forth Bridge was read by Mr F. E. Cooper, the resident engineer, at the recent meeting of the Iron and Steel Institute at Edinburgh. The method of erection was particularly described, full particulars being given of the erecting platforms, which were lifted up by hydraulic pressure as the work progressed. The materials were chiefly hoisted by crucible steel wire ropes, which were found exceedingly trustworthy. Mr. T. C. Clarke, Mr. Henning and Capt. Jones of the Edgar Thomson Steel Works were among those who took part in the subsequent discussion on the paper, and their remarks are fully reported in another column.

The importance of the wind strains on a bridge of this gigantic size was shown by the following figures given by Mr. Cooper, and deduced from the elaborate system of wind gauges of different areas originally erected at the site of the bridge when the design was still unsettled, owing to the uncertainty prevailing as to the probable maximum wind pressure.

The total strain of dead load, live load and wind was 6,000 tons; the dead load was 2,282 tons and the live load 1,022 tons, whilst the wind pressure accounted for the rest. It would, therefore, be seen how important a factor the wind

* Report of General Duane.

pressure was in making the calculations, and the effect of this can be seen in the design of the structure. Looking down the length of the bridge it appears a network of material so that a rifle-bullet could not be fired down without hitting some part. A view crosswise was, however, quite different, for it was quite open in design, thus allowing free passage for the wind blowing up and down the river.

Observations had shown that the wind pressures were not much greater at the top of the cantilever (361 ft. above high water) than lower down. At Inch Garvie (the small rocky islet in the middle of the Forth) an average maximum of 34 lbs. to the square foot had been registered; whilst the wind gauges at the shore ends only recorded 12 lbs. and 22 lbs. respectively. This shows that the strongest blows came in puffs or flaws, and other records confirmed this; for instance, they had had 19 lbs. to the square foot on the big board of their wind gauge, and 38 lbs. on the small one, whilst from another board they had read 32 lbs. On the big board there were two gauges, and the maximum register for one in the middle was 32 lbs.; whilst at the corner the maximum reading was 28 lbs. It was evident, therefore, that a large structure rather than a smaller one was better able to stand against the pressure of heavy winds, for a small span might occupy the whole region of a heavy puff, whilst the mean pressure over a larger area would be considerably less.

It is expected that the bridge will be completed and ready for traffic at the date originally designed, Oct. 1, 1889.

English Methods of Railroad Accounting.

To a person familiar only with American railroad accounts, the report of an English company presents many unfamiliar features. In some respects the English reports are better than ours; in others not so good. It may be said in a general way that the English report tells much more about the finances of the company, somewhat less about its operations and practically nothing about its traffic.

Take, for instance, the report of the London & Northwestern Railway, issued last month. It begins with a general statement of results, not unlike our own Income Account, except that it is rendered twice a year instead of once. We give this statement in full, by way of illustration, as it serves to show the proportion of profits on a typical English line.

	1888.	1887.	Increase.
Traffic receipts, including rents, etc	£5 007,437	£4,932,169	£75,268
Less working expenses	2,583,927	2,533,699	50,228
Profit on half-year's working	2,423,510	2,398,470	25,040
Deduct balance of net revenue account, viz., leases, etc	54,876	46,032	8,844
Net profit of the half year available for interest and dividend	2,368,634	2,352,438	16,196
Interest on debenture stock and loans	480,333	477,235	3,098
Leaving available for dividend	1.888,301	1,875.203	13,098
Dividends as proposed below	1,899.512	1,896.510	3,002
Balance	*Dr.* 11,211	*Dr.* 21,307	10,096
Balance from previous half year	94,802	87,238	7,564
Carried forward to next half year	83,591	65,931	17,660

This is followed by a few statements as to the business of the company and the works in which it is engaged; not amounting to more than four or five pages of an ordinary American report. Gross passenger and freight receipts for the half year are given separately; also number of passengers and tons carried, and train miles, both freight and passenger; but there are no figures which indicate anything about ton and passenger mileage, weights of trains, length of haul, or average rates charged.

The general account is followed by fifteen separate statements. The first eight of these deal with capital account. No. 1 shows the amount of capital in various forms authorized by successive acts of Parliament. No. 2 shows exactly the amount of water on the stock of various forms, thus:

	Amount created.	Credited to June 30, 1888. Amount received.	Nominal additions.	Total.	Unissued stock.
Consolidated guaranteed stock entitled to dividend at the rate of 4 per cent. per annum	£15,100,406	£11,776,120	£3,324,286	£15,100,406	
Consolidated preference stock entitled to dividend at the rate of 4 per cent. per annum	23,080,620	18,961,496	4,119,124	23,080,620	
Consolidated stock	38,926,207	35,943,054	1,919,996	37,863,050	£1,063,157
Total joint stock capital	£77,107,233	£66,680,670	£9,363,406	£76,044,076	£1,063,157

It will be noted that instead of allowing floating debt to accumulate, a certain amount of unissued stock is reserved in connection with capital accounts not yet closed. The form of return is much simpler than that proposed by the Inter-state Commerce Commission, and ought at the same time to be sufficient for all practical purposes.

No. 3 gives a statement of capital raised by debenture stock, the London & Northwestern having no outstanding capitalized obligations except in this form. It is interesting to note, as showing the care exercised in matters of English railroad finance, that the capitalized amount of rent charges is deducted from the amount of loans authorized in order to determine the actual borrowing powers of the company. In other words, the amount of fixed charges is limited by law, if the directors have incurred more obligations in the form of rents, they cannot incur so many in the form of bonds. This is a sensible way of looking at the matter, and it is a pity that it should be so foreign to all American ideas of railroad finance and legislation.

No. 4 is headed "Receipts and Expenditures on Capital Account," and corresponds nearly to an American "General Balance Sheet." (The English apply the term general balance sheet to another account.) The chief difference between the English and American forms of capital account is that the former omits all purely temporary items, such as current liabilities on the one hand, or cash and materials on the other. One characteristic feature of English railroad policy is illustrated by the smallness of the profit and loss balance. On a capital which now amounts to £97,476,594 there has been accumulated from the operations of more than half a century only £279,799 of surplus. The company has been prosperous; but it is the policy of English companies to divide all the money they honestly can.

No. 5 gives details of capital expenditure during the year, in excellent shape. We have more than once urged upon our railroads the importance of doing the same thing. No. 7 gives similar details of proposed expenditures in the immediate future; while No. 8 shows the means available for meeting such expenditures. No. 6 gives details of equipment. It is noticeable that there has been no increase in the number of locomotives nor in the aggregate number of passenger cars; while the trifling increase in freight cars—122 out of a total of 47,249, has been charged to capital account.

No. 9 is called the Revenue Account, but deals only with traffic receipts and expenses, which other current matters are given under in the two abstracts immediately following. The classification of receipts is worth giving nearly in full.

Class.	No.	Amount.		
By traffic, viz.:				
Passengers..First...	908,117	£211,325		
" ..Second.	1,584,369	142,662		
" ..Third	23,777 123	1,050.035		
" . Season.	26,457	87,209		
			£1,491,232	
Parcels, horses, carriages and dogs			309,531	
Mails			91,952	
				£1,892,717
Merchandise		£1,890,951		
Less expenses of collection and delivery of goods by agents		95,339		
			1,795,612	
Live stock			99,632	
Minerals			1,125.082	
				3,020,327
By transfer fees				751
By rents of land and buildings			116,940	
Less repairs and sundries			23,298	
				93,641
				£5,007,436

Expenses are classified under the six heads of Maintenance of Way, Locomotive Power, Equipment, Traffic, General and Steamboats. Well-arranged details under each head are given in Table No. 12. There is no special attempt to separate items of train and station service, except so far as the former are directly connected with locomotive running.

No. 13, entitled "General Balance Sheet," is a treasurer's balance sheet of current items, so arranged as to leave out whatever belongs distinctively in the accounts, either of capital or of revenue, which have been fully balanced. The method is simple and straightforward, but hardly worth describing in detail. Nos. 14 and 15 give statements of mileage and train mileage respectively. The mileage of passenger trains exceeds that of freight, but not so much as on most other English lines.

The report concludes with details of proceedings at the half-yearly meeting of shareholders of the company.

Speaking of the prospect of a settlement of existing rate differences between Western roads, an official of one of the associations at Chicago, whose opinion may be taken as being sound and based on the best of information, said: "There is no doubt in my mind of the establishment of a permanent peace this week. The matter had become so serious that it looked like a choice between bankruptcy or concessions on the part of more than one road. The officials of all lines are a unit in the opinion that matters must be settled for the common protection of all, and with this sentiment in their hearts the managers have been working very hard to bring about the long wished for adjustment of differences. Everybody is familiar with the various factors which have made this year especially disastrous to all Western roads. The opening of the "Soo" line, the St. Paul & Duluth's water route to the east, the strong competition of the vessel owners from Chicago eastward, the advantages enjoyed by the Canadian Pacific through the Inter-state law, and other causes have tended to entirely revolutionize traffic matters in the territory northwest of Chicago, within the past year. The opening of the St. Paul's Kansas City line, the extension of the Santa Fe to Chicago and the warfare between the Alton and its competitors on the question of commissions have kept southwestern business in a turmoil. St. Louis has been bidding heavily for through eastern business, and many inducements have been held out by the direct east and west lines to keep freight and passenger business from going east via Chicago. This was disastrous to Chicago roads, of course, and tended to add fuel to the flame. The unfortunate feature of the situation was that several roads owned lines running northwest, west and southwest of Chicago, so that a disturbance between roads having but one line was sure to draw the rest into the trouble. The warfare between the Wabash and Alton naturally affected the Burlington, Rock Island and St. Paul, and once at it these giants knew no bounds to their warfare. It has run along this way all this year, and the treasuries of the roads have felt the effects most severely. But I believe the abandonment of the fast trains between Chicago and the Missouri River was the flag of truce, and that the day is not far distant when the roads will each be enjoying prosperity. The possibilities of this are strengthened by the approach of the close of navigation, all vessel owners being quite willing that the roads shall raise their rates, thereby enabling them to get liberal rates to close the season.

Crop prospects are exceedingly good, and the roads will have their hands full. In anticipation of this the roads are beginning to order new freight cars.

Mr. C. M. Percy, who is contributing a series of articles to the *Colliery Guardian* entitled "Engineering Notes on Iron and Steel Manufacture, Mining and Mechanics,' gives the British make of pig-iron in 1788, one hundred years ago, as 13,100 tons, made with charcoal, and 48,200 tons made with coke, or 61,300 tons in all. In 1796 the annual production had increased to 125,079 tons, and in 1806 the make had increased to 258,206 tons.

England did not make iron to any extent until Abram Darby, in 1735, introduced the use of coke; in 1740 the total make of pig iron in England was only 17,350 tons.

Between these two extreme dates, 1735 and 1806, almost all of the canal system of England was constructed, Watt perfected his engine and Cort took out his patent for rolling iron. The maximum make of that country was in 1882, 8,493,287 tons; last year the production was 7,441,927 tons, a gain of over 571,000 over the preceding year, which was marked by the smallest production since 1879; and it was about equal to the production of 1872, which was 6,841,929 tons, or 72.9 per cent. of the joint production of England and the United States. At the close of our Revolutionary War our abundant charcoal gave us relatively great advantages in iron smelting, though no statistics are known showing how much iron was produced in this country till 1810, when we were making 53,908 tons. In 1820, according to Mr. Swank, our make fell to 20,000 tons. Great Britain was then making 400,000 tons. In 1854, the first year statistics were collected by the American Iron and Steel Association, charcoal iron constituted almost one-half of our make of 657,338 tons, which was 30.3 per cent. of the joint make of the two countries. Our proportion of the joint make was at its minimum, 14.7 per cent., in 1861, and again in 1865. In the meantime our production had only increased from 821,223 tons to 831 769. Since that, on the whole, our production has increased with considerable steadiness, till last year, when our make was 6,417,184 tons, or 46.3 per cent. of the joint make of the two countries.

Twin screws driven by triple expansion engines have in so many cases proved more effective and economical than the side-wheelers and propellers built a few years ago, that the question of converting old side-wheel steamers into twin screws is likely to arise. The experience of an English railroad company in this direction is therefore interesting. The London & Northwestern Railway some months since placed their paddle-wheel steamer "Duchess of Sutherland" (built in 1869) in the hands of Messrs. Laird Brothers for conversion into a twin-screw steamer with the expectation that her efficiency for their cross-channel cattle trade would be improved, and that considerable gain in economy would result from the introduction of more modern machinery. The work has been completed, and on a recent trial trip the vessel ran 14½ knots, the engines developing 1,400 horse-power. The old machinery, side wheels and boxes were removed, but the forward and after sponsons or guards and their houses on each side are retained and connected, the houses forming quarters for the ship's officers, store-rooms, etc. The old side-wheel space is decked over and formed into a large additional space for cattle. The necessary alterations have been made about the stern of the vessel, and stern tubes and brackets fitted, and the arrangement of engine keelsons, bulkheads, coal-bunkers, etc., have been modified to suit the new machinery. This consists of two sets of triple-expansion engines having cylinders 16⅓ in., 26 in., and 41 in. dia., with a stroke of 30 in., and working at 150 lbs. pressure, steam being provided by two double-ended cylindrical Scotch steel boilers. The carrying power of the vessel has been increased by about 190 tons, large additional deck space for cattle gained, while the net register tonnage has been reduced by 247 tons. The speed has been considerably increased, and the consumption of fuel reduced 60 per cent.

The President of the Baltimore & Ohio has organized a commission of mechanical experts to examine thoroughly all the shops, shop tools, etc., of the entire Baltimore & Ohio system, and to report upon any needed reforms and improvements in the machinery department, looking to more economical and effective work; the modernizing, if necessary, of the machinery, both locomotive and stationary; the concentration of work and the better division of labor between different parts of the system. The commission will visit not only the shops of the Baltimore & Ohio but also those of several of the leading railroads of the United States, with

the view of instituting comparisons and of adopting for the Baltimore & Ohio the most modern and approved methods and appliances to be found in use anywhere. The commission consists of M. N. Forney, mechanical engineer, New York; A. J. Cromwell, Superintendent of Motive Power Baltimore & Ohio lines east of the Ohio River; W. H. Harrison, Superintendent of Motive Power west of the Ohio River; and J. N. Kalbaugh, Master of Machinery, Pittsburgh Division. The commission will begin its work in a few days.

The *Iron and Steel Trades' Journal*, in its two last issues has called attention to a strong feeling developing among shipbuilders in favor of iron plates in preference to steel, owing to the excessive rust said to accumulate on both sides of steel plates. A consultation with naval architects and marine engineers showed a strong expression, on their part, in favor of Midland and Yorkshire iron for shipbuilding purposes rather than either Cumberland, Durham or Lanarkshire mild steel. The *Journal*, which finds that the feeling against steel is much deeper and more widespread than it had believed, thinks it "desirable that Lloyds take steps to make it plain if there is really any ground for the prejudice which is setting in against steel plates for shipbuilding purposes."

The shipbuilding industry has given a powerful stimulus to the open-hearth steel industry of Great Britain. In 1878 only 2,682 tons of steel were used in that industry, against 310,614 tons of iron. Last year 210,340 tons of steel were used against 52,202 tons of iron, and the total consumption of steel in shipbuilding for the last 10 years in Great Britain has been 748,266 tons against 2,785,582 tons of iron, as stated by Mr. Daniel Adamson in his address before the Iron and Steel Institute last May; and the production of open-hearth steel in Great Britain has increased from 175,500 tons in 1878 to 781,104 tons in 1887. The advantage from the use of steel, as stated, is that vessels built of this material will carry four per cent. more cargo than if built of iron. In the meantime, the makers of iron plates for shipbuilding purposes are said to be very busy.

Twenty thousand tons of Connellsville coal have been purchased by parties in St. Paul with the avowed intention of taking it to some port on Lake Erie in the empty cars which bring iron ore to Pittsburgh and from thence in the returning ore carrying steamers to some port on Lake Superior and by cars to St. Paul, there to be coked for local use.

The freight rates on coke, which is bulky, are complained of as very high, and though the 20,000 tons of coal will not produce over 12,500 tons of coke, the freight charges by the route indicated are said to be so low as to give promise of a profit.

This experiment, though it is intended only to supply a local demand in the foundries of St. Paul, will be watched with considerable interest, and may be successful, as coal for coke-making is not injured by being broken up.

The freight cars recently built for the Atchison, Topeka & Santa Fe have safety chains, in order to prevent the train breaking in two when the main coupling parts. The safety chain acts like the extra pins and links in a Potter draw bar, but is more complete, as the safety chains are entirely independent of the draft springs and timbers, and are not affected should the latter break. The usual objection to safety chains is that when the main coupling parts the jerk usually fractures the safety chains.

From a recent report to the Cincinnati Chamber of Commerce on the Ohio River traffic it appears that, although the number of boats engaged in passenger and freight business has decreased considerably in the last four years, the tonnage remains as great. There has been an improvement in the service and most of the boats withdrawn have been transient vessels. The chief freight business is, of course, in coal. No boat was built at Cincinnati in the last two years, and such yards as exist are occupied with repairs alone.

The "Flying Scotchman" express by the East Coast route, London to Edinburgh, on Aug. 28 beat the record by 3 minutes, starting from King's Cross at 10, and reaching Edinburgh at 5.29, or 31 minutes before schedule time. This gives a speed of 52½ miles per hour including stoppages, one being of 20 minutes duration for dinner. It is stated that on this occasion the trip was made with ordinary engines instead of the compounds hitherto used.

Three spans of the Barranca Bridge over the Metlac ravine on the Mexican Railroad between Vera Cruz and Mexico have fallen, the foundations being washed away by a storm of exceptional violence, which has done much damage in Vera Cruz and Orizaba. The National highway bridge near Metlac has also been damaged. It is also reported that a tunnel on the Mexican line is damaged.

The difficulties regarding the regular running of trains on the recently opened railroad connecting Constantinople with the rest of Europe appear to have been surmounted, as the British postal authorities announce that the regular mails will in future be sent by this route, leaving London every morning and evening.

TRADE CATALOGUES.

Railroads and Rolling Stock: A Catalogue giving cost of plant and material for Portable, Light and Main Lines, to which is added a chapter on River Steamers and Light Craft, also Dredging Plant. Prepared by John Birch & Co., Engineers and Merchants, Liverpool.

This is one of the most complete catalogues of its kind ever brought to our notice. The articles are clearly described, the illustrations are numerous, well selected and for the most part original, and the instructions as to the proper method of ordering materials from a great distance are supplemented by a very voluminous telegraphic code. Prices are given throughout serving as a guide for purchasers as to relative cost.

The book is of course chiefly for the use of those at a considerable distance from any manufactory, and in these distant and generally sparsely populated regions the use of the lightest and most portable railroad plant is advisable. The whole subject of portable and light railroads is therefore treated in a comprehensive manner, and many new and hitherto little known special appliances for light railroads are illustrated. Some eleven varieties of steel sleepers are illustrated and described. In some a flange rail is secured to the steel tie by clips, in others bolted fastenings are used, and in others rivets. Different types of splice bars, switches, frogs, etc., are also illustrated.

Rolling stock both for passenger and freight service, is illustrated in great variety, and the majority of the cars present a combination of American and English details, which gives the cars a somewhat bizarre appearance. An ordinary four-wheeled English wagon, for example, constructed for the metre gauge, fitted with the Beuther air-tight journal box (an invention of German origin), and lastly equipped with the Janney draw-bar, may fairly be termed an "international car." It is marked to carry 6 gross tons (13,440 lbs.) and weighs 6,160 lbs. The wheels are 30 in. on tread with steel tires and axles. The outside sills and bolsters are of girder iron. The length of the body outside is 13 ft. 10 in. and the width 6 ft. 6 in. The sides are 30 in. high, while the ends are 38 in., the freight being, if necessary, kept dry by a tarpaulin stretched over a ridge pole. The price taken to pieces and packed is given at $282 f.o.b. Liverpool. This is about the price ($300) allowed in the Rules of Interchange for a four-wheeled drop bottom Gondola car. The greater capacity and the wider gauge of the latter car involves extra cost, which is possibly balanced by the steel tires, oil tight journal boxes, and packing of the English car, but the prices do not seem to differ very materially.

Illustrations reproduced from photographs are given of two box-cars of very similar capacity to our own, but it will be seen that the method of construction and the cost vary considerably:

	A.	B.
Gauge	4 ft. 8½ in.	5 ft. 6 in.
Capacity	40,000 lbs.	45,000 lbs.
Length, body, outside	30 ft.	32 ft.
Width	8 ft. 6 in.	9 ft.
Height, floor to roof, centre	7 ft.	8 ft.
Weight	18,500 lbs.	27,000 lbs.
Body, framing	Pitch pine.	Iron.
" sides	Wood, double.	Iron.
" floor	Wood.	Iron.
Roof	Galvanized, corrugated on T iron rafters.	
Doors	One sliding each side, opening 5 ft. 9 in.	Two hinged each side, in three parts, to carry horses or stock.
Underframe	Steel channels and angle irons.	
Wheels, diameter on tread	33¼ in.	36 in.
" material	Solid wrought.	Solid wrought.
Tires	Bessemer.	Bessemer.
Axles	Scrap.	Low Moor.
Draw-gear	Central, tight coupling.	European, tight coupling.
Truck, pattern	Diamond.	Passenger.
" material	Wrought iron and steel throughout.	
Brake, rigging	All wheels, outside.	All wheels, outside.
" worked from	Roof.	Ground.
Price, packed, f.o.b.	$901.	$1,412.

The price allowed in the Rules of Interchange for a box car under 32 ft. with channel iron truck transoms is only $490, which is very considerably less than the price of the A car above, even allowing for packing, steel-tired wheels, etc. The cost of the car B seems very high, but being entirely of iron and steel, it would doubtless be a very durable car in a hot climate, and the use of easy riding trucks, etc., while enhancing the cost, render it a comfortable car for horses or stock.

The price of a pair of diamond trucks solely made of wrought-iron and steel, with solid wrought-iron wheels, 33 in. on tread, Bessemer tires and axles, patent air tight journal boxes, inside hung brake and check chains, is given packed f. o. b. at $331. The wheels and axles separately are figured at $151 and the trucks alone at $180. The price allowed in the Rules of Interchange for a pair of freight car trucks with channel iron transoms is $250, of which $120 is allowed for the wheels and axles, and $130 for the trucks proper. The greater part of the extra cost is therefore in the trucks, and $30 is in the extra cost of the patent journal boxes as compared with ordinary boxes.

A variety of passenger cars are illustrated, most of them, both for narrow and broad gauge, being arranged on the American plan, with aisles and end platforms. Several of the cars appear to be of American manufacture. A somewhat novel car is an eight-wheeled horse car, suitable for running on passenger trains. The car is adapted to carry six horses, and is fitted with suitable divisions, mangers, etc., and a groom's compartment, with seat, locker, etc., and access to the mangers. The front of the mangers, the hind and head divisions and portions of the roof are padded and covered with horse hide. The horses are therefore not liable to be chafed or injured, even if rendered fractious or nervous by the movement of the train.

Some eight-wheel cars for a metre gauge tramway are also illustrated, and present some points of novelty. In one car the ends are enclosed and the centre open, 32 passengers being accommodated in all. The length of the car over platforms is 30 ft., and the width of body 6 ft. 6 in. A Royal car for the same road is divided into three compartments containing lavatory and attendant's room in addition to the main saloon.

The book contains a large number of illustrations of locomotives, both simple and compound, and of various types and sizes. One of the most remarkable engines illustrated is that used on the Darjeeling line in the Himalayas. The gauge is 24 in., the ruling grade for many miles is 264 ft. per mile, and the sharpest curve is the same as that on the New York elevated, 90 ft. radius. Another specially designed for use in workshops is built for an 18-in. gauge and weighs only 7,300 lbs. The cylinders are 5 in. by 6 in. stroke, and the four wheels are 16¼ in. dia., giving a tractive power of 9.25 lbs. per lb. average pressure in the cylinders.

Two types of locomotives, specially intended for use in yards and workshops, have steam cranes mounted on the boiler. Heavy castings, plates, or tires can be unloaded from cars by means of these cranes, which are very useful and convenient under certain conditions.

Several illustrations are given of the Latigue single rail system of light railroad. One represents part of a small line in the Pyrenees Orientales, at the mines at Ria. It is used for carrying copper ore over a very rugged country, some of the gradients being 1 in 12 (440 ft. per mile), with curves of only 10 ft. radius. The motive power in this case is electricity, which is applied very simply, the conductors being secured to the trestles, and insulated by common wooden brackets. The electricity is generated by the weight of the loaded train going down hill, which charges an electric machine attached to the empty train going up hill. This is found to be quite sufficient for the purpose, and the whole arrangement is said to give very satisfactory results.

The Greenleaf Turn-table Manufacturing Co., of Indianapolis, have just issued a catalogue describing the different styles of turn-tables built, and giving a variety of useful information as to the strength of timber, methods of seasoning, measuring, etc.

The types of turn-tables described embrace: 1, a trussed beam wooden turn-table, 50 tons capacity, intended for temporary use; 2, a prairie table 48 ft. dia., with overhead trussing. This table requires little masonry, and can be easily removed as the tracklaying progresses; 3, cast-iron turn-table, model 1869. This table has since been improved, the original centre being too light; 4, wrought-iron table, model 1878. This table is too light for modern heavy engines; 5, wrought-iron turn-table, model 1882, has a capacity of 100 tons, and it is said that none of them have ever given any trouble. The centre turns on conical rollers; 6, cast girder turn-table, model 1882, has the same end carriage and centre as No. 5, and has done equally well; 7, the Standard Greenleaf Turn-table, model 1887, is made with steel or iron cast girders or riveted wrought-iron girders. No circular track is required, the centre being supported by 16 conical rollers, and steadied against the fixed conical post by 27 conical rollers, the axes of which are vertical. The housings are lipped so as to be dust proof, and the rollers are "free," that is to say, no spindles and no spacing rings are used. The maximum load is 100 tons, and a 60 ft. table requires about 56 cub. yds. of masonry. The makers guarantee the tables with steel or cast-iron girders to last fifteen years without repairs; but the riveted wrought-iron girder tables become flexible from use, partly owing to corrosion, a defect not found in cast girders. We should have thought that this might be prevented by periodical painting.

The catalogue also contains an illustration of a transfer-table for a maximum load of 100 tons.

An illustration is also given of a crucible cast steel turn-table of 175 tons capacity.

The makers state that this 175-ton turn-table can be used without circular track, and is designed for the coming locomotive, now being built for Canadian Pacific, Central Pacific and other railroads that have to haul the present trunk line trains through the Rockies. It certainly appears capable of meeting future requirements of all railroads for some years to come, should the present tendency to consolidate trains continue.

The Manchester Ship Canal.

The *Railway News* (London) states that while some aspects of this undertaking were hotly contested, its physical practicability was never in serious dispute. Since operations were allowed to begin, they have proceeded, and seem likely to continue, with the regularity that attends the great constructive works of our time. What has been done so far has been largely preparatory, though powerful and impressive of its kind, for all along the 35 miles of way armies of navvies and other workmen are encamped and busy, their excavations aided by monster steam-diggers.

To completo the canal within the four years specified in the contract it will be necessary to excavate the material at the rate of about one million cubic yards per month. Since the work has been in operation the contractor has exceeded this amount, the excavation for the month of May amounting to upwards of 1,030,000 cubic yards. A graphic idea of the monthly excavations may be formed if we say that it would suffice to fill a hole 300 ft. square and 300 ft. deep. There are at present in active employment upon the works 56 steam excavators, 73 locomotives, 2,367 wagons, 50 steam cranes, 79 miles of temporary railway, and ,000 men. It is estimated that the undertaking will be completed by the end of 1891, when a waterway twice the width of the Suez Canal and of equal depth will be in active operation.

The channel is being cut entirely through the land, along the southern shore of the estuary—the opposite shore to Liverpool—and up the river nearly 30 miles to its confluence with the Irwell, which last becomes the guide for the remaining distance. The canal entrance in the estuary is at East-

ham Ferry. It is about 6 miles further inland than Birkenhead, perhaps 4 miles further than Rock Ferry, which is also a well-known place, but it is 3 or 4 miles short of Ellesmere Port. It is 7 or 8 miles nearer the sea than the mouth of the tributary Weaver, which the canal is to cut across. The situation of Eastham is also nearly abreast of Garston, the growing port on the opposite, or Lancashire, shore.

The canal is being made semi-tidal, with locks, by which the ships are raised bodily on their passage from the estuary to the level of the quays. Locks at Runcorn, Latchford (by Warrington), Irlam and Barton will effect a rise of 60 ft. 6 in. above the level in the entrance locks at Eastham. Besides the contributions of the Mersey, the Irwell and minor streams, there will be water available from the Thirlmere pipes now laying to Manchester, and also from the springs which the cuttings lay bare. From Runcorn on to Manchester the course of the canal, no longer fettered by the condition of running round an estuary, becomes more direct. The channel has still to be cut, in great measure, regardless of the actual course of the rivers which mainly feed it. Their almost continuous windings forbid a closer use of them. The line of the ship canal, therefore, crosses and recrosses many times that of the natural streams. Here and there are exceptional parts in which the old course and the new can be made to coincide, though with a vast amount of deepening, widening, straightening and diversion. Elsewhere the old river beds are likely to be filled up and disappear altogether. Many an acre of low and swampy land on both sides of the canal, and not merely the disused bits of watercourse, will be redeemed from its present condition, or its liability to inundation, by the "spoil" from cuttings, and, being raised high and dry, its value also may be improved incalculably.

Though the bends of the ship canal are to be as few and wide as possible, 35 miles is still the measured length from Eastham Ferry, in the estuary, to the terminal dock site, which is in the neighborhood of Old Trafford, a Manchester suburb. The work of constructing this 35-mile channel has been divided by the contractor into nine longitudinal sections, of three or four miles apiece. Each is under separate superintendence, and the work of all was begun as nearly as possible simultaneously.

The minimum depth of the canal is 26 ft., the same as the Suez Canal, which is, however, very much narrower, as well as very much longer. The surface width of the Manchester Canal is to vary from 135 ft. at the narrowest to 260 ft. at the broadest. The minimum width at the bottom of its shelving banks is 120 ft., but at the more important parts the bottom width is 170 ft. To get a uniform depth of 26 ft. below the surface of the canal, the actual depth to be dug, hewn or blasted may, of course, often be much more, owing to the inequalities of the natural level. One or two considerable lengths of cutting through 40 ft. of solid rock have to be prepared for. The canal width is enlarged almost to the maximum all the way between Manchester and Barton, which is over 3 miles. It is widened also in the vicinity of the different sets of locks and docks on the route; and it is to be widened at other places, that the largest ships may turn round without obstructing the passage. Steamers of the broadest beam are expected to pass each other easily in the navigable width provided. The calculation has been made that, with the minimum flow of water, the canal could pass daily 25 steamers of 2,000 to 3,000 tons each, 50 of 500 to 2,000 tons, and 100 barges of 50 to 100 tons.

The level of the canal at the entrance and the lower reaches will during the greater part of most tides be that of the deep water outside, so that ships can enter without being locked. Large vessels, it was assumed, will be able to enter through the locks of the canal during a large part of every tide; smaller vessels during nearly the whole of all tides. The sill of the canal entrance will, it is claimed, be 8 ft. deeper than that of any dock in Liverpool, and vessels at Eastham will have a straighter course into the canal by a good broad opening blasted through the rocks. The canal entrance is being made through the rock, and will join the top of the Sloyne, where the channel is also on the rock. As to the geological character of the route, the result of over 170 borings showed that for 27⅓ miles out of the 35 the canal will be on solid red sandstone at a depth of 26 ft. Then, as to the height of railway bridges across the canal at Runcorn and elsewhere, all are to leave 75 ft. of clear headway above the water level, and the few steamers with higher topmasts can get through by telescoping them. The canal directors have issued a circular to ship builders and owners suggesting a change in their form of specification if they have been in the habit of providing polemasts of greater height than, say 70 ft. from light water line.

At Latchford, some 15 miles from the Manchester terminus, docks of nearly 23 acres extent will be constructed to accommodate Warrington; at Runcorn another set of docks and locks is required; and there are to be coal docks at Irlam (near the Irwell and Mersey confluence) and at Barton, near Manchester. The canal locks are in sets of three, placed side by side, the larger and smaller ships and barges being separately accommodated. The largest will hold several ships at once, but they will have intermediate gates to allow a part of the lock to be used without waste of water. Hundreds of vessels may thus pass the locks in a day. The most important of all the dock works will naturally be at the Manchester end of the canal. The act passed in 1885 provides for three docks, named respectively the Manchester, the Salford, and the Ordsal, the combined area of which is 62⅛ acres. The Manchester quay space, extending the whole distance to Barton, has been stated at 6,363 yards. However the making of the canal has not yet gone on for much above half the first of the four years it is to last according to the bargain, and there may be unforeseen wonders in store before the finish. The contractor is Mr. T. A. Walker, of Westminster. The contract price is $28,002.500, of which the company may pay $2,435,000 in fully paid up ordinary shares if they should desire it.

The opening of the canal will, of course, render Manchester a port and consequently develop many new industries, and already negotiations have been commenced to establish shipbuilding yards and marine engine works along the canal. A project to construct a ship canal to Birmingham, nearly 100 miles from the mersey, has also been favorably received.

Speed of Passenger Trains.

The table of the speed of passenger trains between the principal cities, given in our issue of Aug. 24, is supplemented by the annexed statement showing the speed and number of passenger trains running from New York, Philadelphia and Boston to the principal summer resorts, including five points on the sea shore, Bar Harbor, Newport, Long Branch, Atlantic City, and Cape May and four inland or mountain resorts, the White Mountains, the Adirondacks, Saratoga and Richfield Springs. The time, as in the previous table, includes ferries, except in the case of Bar Harbor, where the distance and time given refer to the point on the main land whence the steamer departs for Bar Harbor.

Many of the trains are only run during the summer months, and the speeds given apply only during July and August.

TABLE OF TRAIN SERVICE TO PRINCIPAL SUMMER RESORTS, AUGUST, 1888.

RAILROAD.	WHENCE—WHITHER.	FASTEST TRAIN.				AVERAGE.	
		Distance.	Time.	Speed.	Average distance bet. stops.	No. trains each way per day.	Speed, all trains
Boston & Maine	Boston—Mt. Desert Ferry	297.4	7 45	38.3†	49	3*	28.7
" "	" —Fabyan's (White Mtns)	169	5 55	28.5	10	2	28.3
" " (via Portland)	" " " "	199	7 35	26.2	9	2*	23.9
Boston & Lowell	" " " "	209	7 5	29.5	14	3	26.0
Old Colony	" —Newport	69	2 15	30.7	17	6	24.2
Fitchburg	" —Saratoga	205	6 45	30.4	9	3	28.7
New York Central & Hudson River	New York "	180	4 35	39.3†‡	90	6	27.9
West Shore	" "	179.3§	5 40	31.6	22	6	26.8
New York Central & Hudson River	" —Richfield Springs	272.7	8 45	31.1	23	3	27.3
" " " "	" —P. Smith's (Adirondacks)	439	14 32	30.2	.....	1	30.2
Pennsylvania	" —Long Branch	49	1 20	36.7	.....	9	28.8
Central of New Jersey	" " "	46.6	1 20	35.0*	.....	12	28.6
Pennsylvania	Philadelphia—Long Branch	94.4	2 24	39.3†	12	8	31.5
"	" —Cape May	81.0§	2 3	39.5	.....	5	33.1
" (West Jersey)	" —Atlantic City	64.0§	1 40	38.4	.....	5	32.6
" (Camden & Atlantic)	" " "	59.0§	1 30	39.3	.....	5	38.1
Phila. & Read. (Phila. & Atlant. City.)	" " "	55.2§	1 25	39.0	.....	5	.....

* Via different routes. † Limited trains, extra or parlor car fare charged. ‡ Runs on Saturdays only.
§ Distance does not include ferry.

TECHNICAL.

Locomotive Building.

The Northern Pacific has ordered 85 locomotives from the Baldwin Locomotive Works of Philadelphia.

The St. Joseph, St. Louis & Santa Fe (the St. Joseph branch of the Chicago, Santa Fe & California) has received 10 new freight engines.

The Louisville, New Orleans & Texas has contracted with Birmingham Foundry & Machine Co. for the rebuilding of 30 engines.

The Baldwin Locomotive Works have recently delivered to the North Hudson Railroad Co. 2 dummy engines to be used on the elevated road at Hoboken ferry in case of accident to the cable.

The Altoona shops of the Pennsylvania Co. have this week received an order for 21 class R locomotives.

Car Notes.

It is reported on good authority that the Chicago & Atlantic is about to order 2,000 freight cars.

The Oregon Railway & Navigation Co. is in the market for 600 new box cars.

J. G. Brill & Co., Philadelphia, have an order for 8 cars for the East Birmingham Dummy Line.

The Peninsular Car Works, of Detroit, have received an order from the Northern Pacific for 1,500 freight cars.

The Ohio Falls Car Co., of Jeffersonville, Ind., is to build for the Atlantic & Florida 50 freight and 10 passenger cars.

The American Fire Proof Steel Car Co. is having constructed at the Louisville, New Albany & Chicago shops at New Albany, Md., a mail car embodying the principles and methods used by the company. The company contemplates the erection of shops at Indianapolis.

The Michigan Car Co. were the successful competitors for an order of 750 freight cars for the Union Pacific, the contract for which was let last week.

The Denver & Rio Grande has ordered 500 freight cars. The Michigan Car Co., and the Peninsular Car Co., of Detroit, divided the order between them.

The Missouri Car & Foundry Co. has received an order for 600 freight cars from the St. Louis, Arkansas & Texas.

The Atchison, Topeka & Santa Fe has placed an order with the Missouri Car & Foundry Co. for 200 refrigerator cars of the Tiffany pattern.

The Columbus & Eastern is in the market for a large number of freight cars.

The Pullman Co. is filling an order for 20 dining and sleeping cars for the Mexican National, to be used on the line between the City of Mexico and Laredo, which will be opened this month.

The Nashville, Chattanooga & St. Louis will build large shops at Nashville, Tenn.

The United States Rolling Stock Co., Anniston, Ala., is building an addition to the rolling mill, 100 × 210 ft.

Bridge Notes.

Combined or separate bids are asked for the masonry and superstructure for a wooden bridge across Octoraso Creek, S. C. Slaymaker, of Lancaster, Pa., engineer. Address the County Commissioners, Lancaster, Pa., until September 27th.

Proposals will be received until September 17th, for building an iron or steel bridge over Chapman's Creek, Tremont, O. Address, I. F. Serviss, Springfield, O.

The Old Colony has built a new iron bridge at Wareham. The Fitchburg road will build an iron highway bridge at Orange, Mass.

The Atlanta Bridge & Axle Co., which has the contract for building the four span bridge over the Ocmulgee River at Macon, Ga., has recently completed the following bridges for the Central of Georgia: Draw and fixed span over the Columbia River on the Blakely extension; five span, across the Chattahoochie at Columbus; one span, over Walnut Creek at Macon, Ga., and one span over Courkee Creek, on the Southwestern division.

A combination Howe truss bridge is to be built at Keytesville, Mo. Particulars may be obtained of John H. Lee of that place.

The Chattanooga & St. Louis intends to build a bridge across Duck River near Normandy, Tenn.

The St. Paul, Minneapolis & Manitoba is constructing a stone arch bridge at Sauk Centre, Minn.

A highway bridge, 600 ft. long and 60 ft. wide, is to be built over the Pennsylvania Railroad and Assanpink Creek near Trenton, N. J.

The Chicago & West Michigan bridge over Crook's Creek at Newaygo, Mich., was carried away Sept. 9, by the breaking of a dam above it.

The new bridge connecting Allegheny City and Pittsburgh at Thirtieth street, built by the Keystone Bridge Company, was opened to the public Tuesday, Sept. 11. There are three spans, the end ones being each 229 ft., long, while the middle span is 305 ft. The driveway for carriages is 22 ft. wide.

The Central of New Jersey has recently awarded to a bridge building firm of Philadelphia contracts for structural iron amounting to over 125 tons. Some of this material is to replace bridges on the line east of Bound Brook and on the Newark branch.

The contract for building an iron bridge at Lettuman, W. Va., has been awarded to the Smith Bridge Co., of Toledo, O.

Manufacturing and Business.

Mr. J. T. Chamberlain, Superintendent of the Burton Stock Car Co.'s works at Wichita, will hereafter perform the duties of Purchasing Agent, Mr. R. C. Vidler having resigned.

Thomas Midgeley and others will build works at Beaver Falls, Pa., for the manufacture of wire belting.

The Bessemer Manganese Mining & Furnace Co., of Little Rock, Ark., organized to buildan iron furnace to cost about $50,000, is asking for bids for construction of the works.

The Baker Engine and Machine Co., of Geneva, Ohio, has been organized, with a capital stock of $100,000, by S. M. Carpenter and others.

The Boies Steel Wheel Co., of Scranton, Pa., has been incorporated with a capital stock of $500,000.

A charter has been granted to B. F. Richardson, H. B. Lupton and others, of Covington, Ky., under the name of the Richardson Axle & Wheel Co., with a capital of $200,000.

The Hart-Wood Switch Co. is having a large number of its patent switches manufactured at the car works of the Elyton Land Co., Birmingham, Ala. The Tennessee Coal, Iron & Railroad Co. is putting in a number of these switches.

Iron and Steel.

The Atlanta & North Carolina Railroad wants to purchase steel rails for about 60 miles of road. Address Washington Bryan, President, Newburn, N. C.

The Reading Iron Works resumed operations on the 27th ult. The employés, about 230 in number, are to receive an increase of five per cent. in wages over what was paid previous to the shutting down of the works.

The Lackawanna Iron & Coal Co. has obtained a new charter, and will hereafter be known as the Lackawanna Iron & Steel Co. The capital stock has also been increased from $1,000,000 to $3,000,000.

The Bethlehem Iron Co., of Bethlehem, Pa., has recently been rolling 90-lb. steel rails for the Philadelphia & Reading.

The Rail Market.

Steel Rails.—Quotations continue $28.50@$29 at Eastern mills. One Southern road has bought 8,000 tons at private terms.

Old Rails—Still high; sellers and buyers are 50c.@$1 apart A bid of $25 for 2,000 tons of tees was refused. The new York, New Haven & Hartford asks bids till Sept. 15 for 1,000 tons tees delivered at New Haven or Bridgeport.

Spikes, $2.15@$2.20; angle bars, 2@2.05c.

Safety Guard for Car Trucks.

A safety guard for car trucks has been patented by Mr. William H. Walker, of Martinez, Ga. Combined with the truck frame is a cross-braced connection bent downward at the ends, which carry shoes supported just above the rail in front of the wheel. The shoes are flanged and are intended to drop on the rail and serve as a brake in case of breakage of a wheel or axle.

Combination Coal and Grain Cars.

The Chesapeake & Ohio will build at its shops 250 combination coal, coke and grain cars, to run between Chicago and Richmond, Va., over the C. & O. and the C., I., St. L. & C. roads, hauling coal and coke west and grain east. These cars are to be of 60,000 lbs. capacity, and will be so constructed that they can be unloaded or loaded with coal or coke as conveniently as a common coal car, and yet carry grain as well as a box car.

Locomotive Notes.

The Vandalia will soon have five 50-ton passenger engines in service on the Terre Haute & Indianapolis division. The engines were built at the Pittsburgh Locomotive Works, and are intended to haul fast live stock trains.

Passenger engines for stock trains sounds a trifle odd at first; but as cattle now travel faster than human live stock there should perhaps be a new term invented to designate a class of engines above both freight and passenger.

Car Notes.

The Norwood shops of the New York & New England have recently completed 20 new passenger cars painted the standard color of the road outside, and finished in mahogany inside, the head lining being unusually light in color. They are furnished with double windows.

The Fitchburg road is completing a lot of 400 box cars at its shops at Charlestown, Mass., at the rate of four a day. Fifty stock cars are being built and work has just been finished on a lot of 50 cars for the transportation of carriages. All these cars are equipped with the Jewett truck and the Westinghouse new triple valve freight brake. This company has now nearly 500 freight cars equipped with the new brake and is putting it on all new cars.

Coal on the Central Pacific.

It is reported that the Grass Creek coal mines will be reopened by the Central Pacific road. At present much of the coal used on that road is drawn from the Pleasant Valley mines, and, it is said, gives better satisfaction than any other yet experimented with.

A Railroad in Siberia.

The St. Petersburg *Gazette* gives some details about the Obi Railway, the construction of which has been intrusted to M. Golokhvastow. The Kara Canal, by means of which

the Obi will be shortly connected with the Yenisei, will insure a brilliant future for the other enterprise. The railway will be laid down from the village of Obdorskoé, situated near the source of the Obi, to the Kara Sea, which is navigable for several months in the year. The line will be about 260 miles long. The Obi and Yenisei rise in the most fertile parts of Siberia, and it is said that in the Tomsk Province the production of wheat exceeds by from 11,000,000 to 18,000,000 bushels the consumption. If other articles of produce are added, it is computed that the basin of the Obi will furnish the railroad with about 25,000,000 rubles' worth of traffic annually.

A Railway Through the Pyrenees.

A scheme is afloat for building a railway across the Pyrenees, and arrangements are being made by the principal railway companies for its commencement at an early date. The new route will form a continuation of the Huesca branch of the Northern Railway of Spain, and it will gain access to France through the Somport Pass. The junction with the French system will be effected at Oloron, on the Midi Railway. It will be necessary to pierce the mountains at the summit of the Somport Pass by a tunnel 4½ miles long, and the highest altitude attained will be over 4,000 ft. above the sea.

Improvements in Pullman Sleeping Cars.

Two sleeping cars, "Beethoven" and "Mozart," have just been built by the Pullman Palace Car Co. to run on the New York & New England. Among the new features is the arrangement of the water system. Valves in connection with the Westinghouse air-brake reservoir enable the water, stored in tanks under the car, to be forced through the piping by the air pressure, doing away with all pumps and tanks inside the car. The car is extra large, having 14 sections, a smoking room and a drawing room. The toilet rooms are increased in size and more conveniently arranged.

The Louisville & Nashville Decatur Shops.

Work on the Louisville & Nashville shops at Decatur, Ala., is progressing rapidly, 170 men being employed. When complete they will be much larger than other shops on the line of this road south of Louisville. The buildings are in the southern part of the city, and are of solid brick and stone, with slate and metal roofing. The foundation consists of over 3,500 yards of masonry. The site, which covers 53 acres, is well drained, and the buildings will be well ventilated and lighted so as to insure the health of the workmen.

Following are the dimensions of the buildings: Engine house, 440 ft. diameter on its outer circumference; its capacity is to be doubled in the near future. Machine shop, 125 × 127, with octagonal smokestack 90 ft. high; blacksmith and boiler ship, 72 × 122; foundry, 84 × 93; planing mill, 92 × 103, and two stories high; freight car shop, 72 × 122; passenger car shop, 92 × 107; paint shop, 92 × 102; stationary engine house, machine shop and stationary engine house planing mill are each 35 × 88; wheel shop, 52 × 62; sand and wood house, 40 × 104; a general office and store, 50 × 75, three stories high, attic and basement; oil house, 34 × 49; dry house, 28 × 100; brass foundry, 52 × 88; freight buildings, 60 × 100.

These shops will cost, completed, $900,000, and will be ready by Dec 1.

THE SCRAP HEAP.

Perfection.

A paper down South, where rhetoric is indigenous, has the following:

"The Superintendents of the various divisions of the Blank Railroad have just completed their examination of all the trainmen on the rules governing the movement of trains, and all are gratified with the proficiency of the men generally. With but few exceptions they were found to be thoroughly posted as to the rules, while they, as well, carefully observed them. The trains all over the system were found clean and well kept; the uniforms of the men preserved a commendable neatness, and complaints from passengers were rather the exception than the rule by large odds. Not one accident occurred during the past year through ignorance of the rules on the part of the employés, and evidences of negligence were found to be very rare indeed. In all the cities on the line of the various divisions the railroad men spoke very highly of both freight and passenger crews, and the superintendents were complimented on all sides on the smooth working of all departments of the system. Few roads in the country have their trains better manned than the ——, and ladies and children are as safe in the care of the trainmen as if accompanied by their friends or relatives."

A New Siberian Railroad.

A St. Petersburg dispatch of Sept. 6 states that surveys have been completed to Irkutsk for a new railroad, and the work of building the road will soon be begun. It is intended to construct a branch to the Transbaikalia Province, between Lake Haikal and the Chinese frontier.

Speed of Lake Freight Carriers.

A very decided spirit of rivalry has sprung up between the commanders of two propeliers, the "Chemung" and the "Oswego," built and engined from designs of Mr. George B. Mallory of this city. On a late trip from Buffalo to Chicago the "Chemung" made the best time of a freight carrier, 62 hours and 30 minutes. The "Oswego," according to the *Marine Journal*, of this city, has now made the same trip in 61 hours and 7 minutes, beating the "Chemung's" time by 1 hour and 23 minutes. The run from Mackinaw to Chicago, 517 miles, was made in 21 hours and 7 minutes, or at the rate of about 15 miles an hour. The whole distance from Buffalo to Chicago is about 950 miles and the coal consumption was 120 tons.

Counterfeit Tintinnabulations.

A Kansas City dispatch says: For several weeks past the Kansas City Cable Company have been aware that crooked work was being done by some of the employés, but were unable to locate it, until unexpectedly aided last week by the finding of a small but clever device called the "brother-in-law." The conductor was discovered by a spotter, who noticed a slight difference in the sounding of the register bell, and further developments brought to light the "brother-in-law" found by a workman near Troost Park. It consists of an oval-shaped piece of silver about the size of a silver dollar, which could easily be concealed in the hand, inside of which was a gong connected with a spring which, when pressed, struck the plate of silver and imitated the register bell so closely as to deceive all but an expert. The conductor would hold one of these in his hand and taking the fares in crowded cars or in the dark would place his hand over the face of the register and pressing the spring of the bogus bell would deceive all. Saturday night eight conductors were laid off to await examination, but some of the manipulators of the little machine in confessing their thefts state that as high as $40 had been stolen in one day. President Smith stated that for several Sundays lately there has been a considerable shrinkage in the receipts, in some cases amounting to $400 or $500. It is reported that the device was introduced in this city by a man from Chicago, who sold them as chestnut bells for $5 each.

Form N. G. 1.

The New York daily *Paper Waster* prints the following:

All ticket agents take pride in having a handsome case, with the tickets so systematically arranged according to cities and forms that they can put their hand on the one called for at a moment's notice. It is pardonable hypocrisy to want the case to always appear full to the spectator with no vacant hooks. The Delaware, Lackawanna & Western road has gotten out a very neat form to use as a "filler." The destination marked on it is "Squedunk," and it is reached by the "Stony Hollow Railroad," the rails of which are yet to be laid. Stamped on the ticket are the expressions "Form N. G. 1," and "Not good for one first-class passage." These tickets have never been offered for sale, but importunate friends of the agents, who ask for passes to some quiet summer resort, have been fitted out and known to get as far as the depot in Hoboken at an early hour in the morning. Such persons never ask for passes again.

The form most needed for ticket agents' friends is one for those whose absent-mindedness leads them to ask for a ticket to the town from which they are just starting. The application at Paterson for tickets to Paterson (instead of to New York, the real destination) are doubtless more frequent than those for quiet summer resorts. Tickets for these people could be sold for nothing—the satisfaction of pleasing patrons being sufficient pay for the pasteboard—and would fill a long-felt want.

An Employes' Trust.

General Manager—Ah! hem! By the way, Mr. Typewrighter, you remember I said I should not need your valuable and highly appreciated services after this week?

Asst. to Gen. Mgr.—Yes, sir; you said you had found by advertising that you could get a female Secretary just as competent for less wages.

G. M.—"True. I found a young lady so highly recommended that I engaged her, but this morning I received a note from her declining the place."

A. to G. M.—"Yes. I know about it. She and I have formed a trust to lessen the supply of labor and keep up wages."

G. M.—"Eh?"

A. to G. M.—"I have married her."

Storms.

A dispatch from the City of Mexico, Sept. 10, states that a severe storm which had been raging at Vera Cruz and along the Gulf coast had seriously damaged the Mexican (Vera Cruz to Mexico) Railroad. Three spans of the magnificent iron bridge at Barranca fell, and there was danger of one of the important tunnels caving in. The bridge was 90 ft. high and was built on a curve.

A flood in the New River last week carried away the iron bridge of the Chesapeake & Ohio Railroad at Grand View, W. Va., involving a loss of $50,000.

Serious damage has been done by heavy rains to the Americus, Preston & Lumpkin and the East Tennessee, Virginia & Georgia.

A Relief Association on the Reading.

A Philadelphia dispatch of Sept. 12 says: President Corbin of the Reading has proposed to the company's employés the organization of a relief or mutual insurance association. The plan divides the fund into five classes. The death benefits range from $250 to $1,200 for the five classes, and other features are similar to those of existing associations. The railroad company proposes to become a contributor to the amount of 10 per cent. of the sum contributed by the employés until the fund reaches $1,000,000, and to contribute 5 per cent. after it has exceeded that sum. The company guarantees to make up to the extent of $100,000 any deficit in the sum prior to its reaching the total contribution of $1,000,000.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago, Milwaukee & St. Paul, 2½ per cent., semi-annual, on preferred stock.

Chicago & Northwestern, 1¾ per cent., payable Sept. 24.

Manhattan (Elevated), 1 per cent., quarterly, payable Oct. 1.

Sunbury & Lewiston, semi-annual, 3 per cent.

Western Union Telegraph, 1¼ per cent., quarterly.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Dubuque & Sioux City, special meeting at Dubuque, Oct. 3, to amend the articles of incorporation and the by-laws; also to act on the purchase of the Cedar Rapids & Chicago, the Iowa Falls & Sioux City and the Cherokee & Dakota.

East Tennessee, Virginia & Georgia, special meeting, Knoxville, Tenn., Oct. 18.

Ithaca, Auburn & Western, annual meeting, 111 William street, New York City, Oct. 1.

Louisville & Nashville, annual meeting, Oct. 2.

Lake Erie & Western, annual meeting, Oct. 3.

Minneapolis & St. Louis, annual meeting, Minneapolis, Minn., Oct. 3.

New York & Northern, annual meeting, 96 Broadway, New York, Oct. 15.

Northern Pacific, annual meeting, Mills building, New York City, Sept. 20.

Ohio & Mississippi, annual meeting, Union Depot, Cincinnati, O., Oct. 11.

Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *National Association of General Passenger and Ticket Agents* will hold its fall meeting at the United States Hotel, in Saratoga, N. Y., Sept. 18.

The American Society of Mechanical Engineers will hold its eighteenth convention and ninth annual meeting in Scranton, Pa., beginning Monday evening, Oct. 15.

The *Association of North American Railroad Superintendents* will hold its next meeting at the Southern Hotel, St. Louis, beginning Sept. 19.

The *American Institute of Mining Engineers* will hold its fifty-second meeting at Buffalo, N. Y., beginning on Tuesday evening, Oct. 2, 1888.

The *American Association of Railway Chemists* will hold its next meeting in Baltimore, Md., in October.

The *New England Railroad Club* meets at its rooms in the Boston & Albany passenger station, Boston, on the second Wednesday of each month.

The *New York Railroad Club* meets at its rooms, 113 Liberty street, New York City, on the third Thursday of each month.

The *Western Railway Club* will hold its next meeting on the third Wednesday in September, at the Grand Pacific Hotel in Chicago.

The *Central Railway Club* meets at the Tifft House, Buffalo, the fourth Wednesday of January, March, May, August and October.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its next regular meetings at its rooms in the Boston & Albany station, Boston, at 7:30 p. m. on the third Wednesday of September.

The *Western Society of Engineers* holds its regular meetings at its hall, No. 15 Washington street, Chicago, at 7:30 p. m., on the first Tuesday of each month.

The *Engineers' Club of Philadelphia* will hold its next meeting at the house of the Club, 1,122 Gerard street, Philadelphia, Oct. 6.

The Engineers' Society of Western Pennsylvania will hold its next meeting at Pittsburgh, Sept. 18.

American Society of Civil Engineers.

The first regular meeting after the summer vacation was held Sept. 5.

Mr. E. E. Magovern read a paper on the Theory of Aqua-Ammonia Engines with Results of Tests. The tests were made with an engine of this type running an Edison incandescent plant. The result as to power was that about 58 h. p. was developed with the weak solution of aqua-ammonia against 32 h. p. with steam.

The following were elected:

Members.—William James Baldwin, New York City; Elbridge Leonard Brown, Brockton, Mass.; Enward Bertie Codwise, Chief Eng. Ulster & Delaware, Kingston, N. Y.; Walter Whaley Curtis, Res. Eng., Fort Madison Bridge, Fort Madison, Ia.; Arthur Powis Herbert, Loc. Eng. Mexican National Construction Co., City of Mexico; Edward Maguire, Capt. of Engs., U. S. A., Willet's Point, N. Y.; Arthur John Mason, Asst. City Eng., Kansas City, Mo.; Charles Henry Nash, Bloomfield, N. J.; William Scherzer, Keystone Bridge Co., Chicago, Ill., William Humphrey Wightman Asst. Eng. in Charge of Construction, Spokane & Palouse Ry., Palouse, Wash. Ty.

Associate.—William Gibson, Jr., *Engineering and Building Record*, New York City.

Juniors.—St. John Clark, Res. Eng. for Passaic Rolling Mill Co. at the Manhattan Bridge, High Bridge, N. Y.; Walter H. Gahagen, Asst. Res. Eng. I. V. & N. R. R., La Salle, Ill.; Mason Delano Pratt, Asst. Eng. Johnson Steel Street Rail Co., Johnstown, Pa.

Engineers' Club of Kansas City.

A regular meeting was held at the rooms of the Club the evening of Sept. 3. Sixteen members and nine visitors were present. Messrs. Walton Clark and Edmund Saxton were elected members.

Mr. Harris described a new cable grip of his own invention. A communication from Mr. John F. Wallace on Flood Waves of the Missouri River was read and discussed. Also a letter from Mr. B. W. DeCourcy on the Shrinkage of Embankments.

PERSONAL.

—Assistant General Superintendent C. W. Case, of the Chicago, Milwaukee & St. Paul, has resigned his position on the northern district, and it is reported that he is to become General Superintendent of the St. Paul, Minneapolis & Manitoba.

—Frank C. Smith, who formerly represented Shoenberger & Co., of Pittsburgh, Pa., steel manufacturers, but has lately held the office of Master Mechanic of the Peoria, Decatur & Evansville, has resigned that position to again represent Shoenberger & Co.

—Judge Cornelius Lynde, of Rock Island, Ill., President of the Rock Island & Peoria, and Director in the Burlington, Cedar Rapids & Northern, died Sept. 6. He was one of the best known bankers of Western Illinois, and a heavy stockholder in the Chicago, Rock Island & Pacific.

—Thomas W. Burrows, who has just been appointed General Superintendent of the Chicago & Atlantic, was born in England in 1851, and commenced his railroad career in 1864 on the Cleveland, Columbus & Cincinnati as water boy. Since then he has been telegraph operator, train dispatcher, train master, assistant superintendent, and, since 1883, superintendent of the Indianapolis & St. Louis.

—George R. Blanchard, Chairman of the Central Traffic Association, tendered his resignation at a meeting of the Association, Sept. 6, but it was not accepted, and will be held in abeyance probably till Jan. 1. It is reported that the lack of harmony in the Association owing to the independent course that has been pursued of late by some of the roads is the reason for this step by Mr. Blanchard, but this is contradicted, and contemplated engagements in other affairs in the East, which were alluded to in connection with a rumored resignation some months ago, seem to be the real reason. Mr. Blanchard was promised a leave of absence from Oct. 1, and it is said that he is going to Europe in the interest of his new business.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—D. C. Courtney has been appointed Division Master Mechanic of the Western division, with headquarters at Coolidge, Kan., in place of C. M. Taylor.

Bowling Green, Hartford & Ohio River.—The directors of this new Kentucky road are: L. W. Rice, G. J. Grammar, Azro Dyer, of Evansville, Ind.; R. D. Williams, Peoria, Ill.; T. C. Carson, Morgantown, Ky.; E. D. Walker, Hartford; W. B. Noe, Calhoun, Ky.

California Southern.—J. B. Somers has been appointed Chief Train Dispatcher.

Carolina, Knoxville & Western.—The following are the officers of this company: J. B. Humbert, President, Princeton, S. C.; T. P. Branch, First Vice-President, Augusta, Ga.; T. N. Cooper, Second Vice-President, Barnard, N. C.; Samuel McKinney, Third Vice-President, Knoxville, Tenn.; A. B. Byrd, Secretary and Treasurer, Greenville, S. C.; J. W. Fletcher, Assistant Secretary, Knoxville, Tenn.; J. T. Stone, Chief Engineer, Greenville, S. C.

Chicago & Atlantic.—At the meeting in Chicago, Sept. 10, the old board and officers were re-elected. T. W. Burrows, recently of the Indianapolis & St. Louis, was appointed Superintendent in place of B. Thomas, resigned. W. O. Johnson was chosen assistant to the President and general solicitor.

Chicago, Santa Fe & California.—John J. Byrne has been appointed Assistant General Passenger Agent at Chicago. F. C. Gay has been appointed Assistant General Freight Agent at Kansas City. C. A. Parker, who has been Assistant General Freight Agent at Kansas City, will hereafter have his office in Chicago.

Cincinnati Southern.—The freight and ticket office of the company at Louisville, Ky., abolished some months ago, has been re-established, and W. H. Newman made General Agent there.

Columbia & Northwestern.—The following are the Directors of this new Dakota company: G. M. Lyon, Geo. E. Hill, J. H. Taylor, F. H. Townsend, A. Ramhaster, C. E. Baldwin and I. Hunsberger, all of Columbia, Dakota.

Davenport (N. Y.)—The following are the officers of this new road: William McDonald, President; John Bell, Vice-President; Josiah D. Beard, Secretary, and John L. Beardsley, Treasurer, all of Davenport, N. Y.

Georgia Pacific.—Maj. Green B. Manley has been appointed General Agent at Atlanta, vice B. F. Wyly, resigned.

Georgia Southern & Florida.—A. C. Knapp, late Superintendent of the Southwestern Division of the Central of Georgia, is appointed Traffic Manager.

Gulf, Colorado & Santa Fe.—J. J. Tomlinson has been appointed Master Mechanic, vice M. T. Carson, who has returned to the Mobile & Ohio, which he left in 1887.

Harrisburg, Portsmouth, Mt. Joy & Lancaster.—The following directors have been elected for the ensuing year: Edmund Smith, George B. Roberts, Wistar Morris, N. Parker Shortridge, James Young, Lewis Elkins, A. J. Cassatt, John P. Green and John P. Wetherill. The road belongs to the Pennsylvania.

Kansas City & Southern.—The stockholders have re-elected the following board of officers: President and General Manager, Col. Wm. Bailey, of St. Louis; Vice-President and Treasurer, James A. Blair, of Kansas City; Secretary, Dewitt C. Blair, of Blairstown, N. J.; Assistant Secretary, J. H. Frost, of Kansas City; General Solicitor, John O'Grady, St. Louis. The directors passed a resolution to remove the general offices from Clinton to Kansas City, Mo., at once.

Los Angeles & Pacific.—The following are the directors of this new California road: Cornelius Cole, Everett E. Hall, Richard C. Shaw, E. C. Burlingame, S. W. Luitweiler, James M. Hale and W. F. Spilman.

Mexican National.—J. L. Whitsitt has been appointed Master Mechanic of the Mexican division, with headquarters at New Laredo, in place of John Grace, resigned.

Philadelphia & Reading.—P. O. Ford has been appointed Division Engineer of the North Pennsylvania & Bound Brook Division, with office in Philadelphia, vice J. S. Ward.

Pittsburgh, Cincinnati & St. Louis.—H. J. Miller has been appointed Superintendent of the new division between Cincinnati and Logansport. Office at Richmond, Ind.

St. Paul & Duluth.—A. B. Plough, late General Freight Agent of the Central Iowa, has been appointed General Freight and Ticket Agent.

Texas Trunk.—Col. W. W. Lake, of Dallas, Tex., has been elected President in place of John L. Henry resigned.

Toledo & Ohio Central.—C. J. Canda, of New York; C. G. Hickox, Cleveland, and John F. Cline, of Toledo, have been elected directors. The board of directors re-elected the old officers as follows: Stevenson Burke, President; C. J. Canda, Vice-President; J. F. Cline, Treasurer and Secretary, and J. M. Ferris, General Manager.

OLD AND NEW ROADS.

New Companies Organized.—Chattanooga, Cleveland & Murphy.—Davenport.—Little Falls, Van Hornesville & Otsego Lake Narrow Gauge.—Los Angeles & Pacific.

Alabama Great Southern.—The company has filed at Chattanooga, Tenn., a mortgage for £1,160,000 sterling. It is in favor of the Central Trust Co., New York, trustee, and is to provide funds for extensions and improvements.

Allentown Terminal.—This new local road, lately organized at Allentown, Pa., is to be built in the interest of the Central of New Jersey. It has the authority of the city council to lay tracks in the streets, work to be begun within a year. The Lehigh Valley is also taking steps to secure additional facilities; it is surveying a line through the Jordan meadows, and is negotiating for the purchase of large tracts of land.

American Midland.—The Akron & Fort Wayne, of Ohio, has been consolidated with this Indiana company. Surveys are being made eastward from Fort Wayne.

Atchison, Topeka & Santa Fe.—The company has purchased a tract of land in Chicago upon which to erect extensive shops.

Atlantic & Danville.—Tracklaying on this road, which is being extended from Norfolk, Va., westward, has been completed as far as Hicksford, where it crosses the Petersburg Railroad 75 miles west of Norfolk, and regular trains are now running through to that point. The work of constructing the road westward from Hicksford will be rapidly pushed, and Lawrenceville, Brunswick Co., will be soon reached. The line is being built of standard gauge with 56-lb. steel rails. The company owns extensive grounds and river front at Norfolk Harbor. Local aid to the amount of $525,000 has been granted the road, payable in six per cent. bonds of the respective municipalities, to be delivered when the road reaches them. It is stated in New York that sufficient funds have been secured to complete the road to Danville.

Buffalo & Williamsville.—Pierson, Crocker & McIntyre, of New York City, have taken the contract for building this road. It is projected to extend from Buffalo, N. Y., east 10 miles to Williamsville. A Buffalo paper states that the line originally surveyed will not be followed, on account of the exorbitant demands of land owners.

Canadian Pacific.—The construction of the South Ontario & Pacific line, which is projected to connect Toronto with Hamilton (parallel to the Grand Trunk main line), has been commenced between Bronte and Oakville by a large force of men.

Cape Fear & Yadkin Valley.—A survey is being made for the extension from Mt. Airy, N. C., northward to connect with a branch of the Norfolk & Western, which is being surveyed southward from the main line of that road.

Carolina, Knoxville & Western.—Twenty miles of the road is about completed and work is progressing vigorously. The line south from Greenville, S. C., is graded for 105 miles.

Central of Georgia.—The extension from Blakely, Early County, Ga., the present terminus of the Albany and Blakely branch of the Southwestern system, is completed to the Georgia bank of the Chattahoochee River, 13 miles, and was opened for traffic Sept. 4. The bridge across that stream, to provide an entrance to Columbia, Ala., the objective point, is well under way, its completion being expected by Nov. 1. With the trestle approaches it will cost about $70,000. Pending the completion of the bridge, arrangements have been made to ferry freight across from the present terminus of the road.

Chattanooga, Cleveland & Murphy.—An application for a charter has been filed in Hamilton County, Tenn., for a road by this name to be built from Chattanooga through Cleveland, Tenn., to Murphy, N. C. The surveys have already been made.

Chiapas.—Mr. George Wilson, 42 Drexel Building, New York, has a concession, with a subsidy of over $4,000,000, from the Mexican government, for a road from the port of Tonola, on the Pacific Coast, in the state of Chiapas, through the state capital, San Christobal, 238 miles of road and branches, terminating on the Tobasco River at the point where it becomes navigable by steamers from the Gulf of Mexico. It passes through coal and iron fields and logwood and mahogany forests. Proposals for construction are invited.

Cincinnati, Hamilton & Dayton.—Work has been commenced at Piqua, O., on an extension of the Piqua & Troy branch from that place northwest, and it is reported that the objective point is Decatur, Ind., where connection is to be made with the Chicago & Atlantic. Property owners at Piqua have secured temporary injunctions restraining the company from building through that place on the route selected.

Cœur D'Alene Railway & Navigation Co.—This property has been sold to the Northern Pacific as noted elsewhere. Its capital stock is $1,000,000, and has paid 8 per cent. There are $360,000 of 6 per cent. bonds outstanding. The report for the year ending March 31, 1888, showed a surplus over dividends of about $20,000.

Davenport.—A corporation has been organized by citizens of Davenport, Delaware County, N. Y., to build a road from that place to the Albany & Susquehanna Division of the Delaware & Hudson Canal Co.'s road at the junction where it is intercepted by the Cooperstown & Charlotte Valley road. The length of the proposed line is about 13 miles. Thirteen thousand dollars has been subscribed.

Denver & Rio Grande.—Surveyors in the interest of this road are at work north of Santa Fe, N. M. A despatch says: The wisdom of extending the mountain system of roads into New Mexico has long been admitted. There is some talk of extending the line from Espanola direct to Albuquerque, but this route lies through a trackless desert of rock, sand and precipitous canyons, not a human habitation on the entire route of 125 miles, whereas should the extension go via the fertile valleys of Pojoaque, Tesseque, Santa Fe and Gallisteo, the best farm and fruit region in New Mexico would be penetrated. The line would touch the anthracite and bituminous coal fields of Cerrillos, and open the gold, copper, silver and lead mines of Santa Fe and Bernalillo counties to Colorado. The line would compete with the Atchison, Topeka & Santa Fe at Santa Fe, Cerrillos, San Pedro, Albuquerque and numerous intervening agricultural villages.

East Birmingham.—The contract for grading the extension of this local road at Birmingham, Ala., to Gate City and Irondale has been let to Dunn & Dabney.

Fitchburg.—The company is building extensive car shops at Fitchburg, Mass., which it is said will constitute the largest plant of the kind in New England.

Fremont, Elkhorn & Missouri Valley.—This company opened for passenger traffic on Sept. 2 the South Valley extension from Geneva to Superior, also the extension from Creighton to Verdigris on the Niobrara branch.

Hickman & Tiptonville.—The charter, franchises and other effects of this company have been transferred to the Georgia, Tennessee & Missouri Railroad Co. on condition that the line be built at once.

Houston & Texas Central.—The road was sold on Sept. 8 at Galveston, Tex., by Charles Dillingham, one of the receivers, under a decree of the United States Court. The main line and all its branches, except the Waco & Northwestern Branch, was sold to F. P. Olcott, of New York, President of the Central Trust Co., for $10,580,000. The Waco & Northwestern Branch was sold to George E. Downs, of New York, for $25,000, subject to a first mortgage of $1,140,000. The Central Trust Co. is a party to the proposed reorganization of the company, and in the articles of reorganization is named as purchasing trustee. The plan of reorganization, which is acquiesced in by over 60 per cent. of the mortgage bondholders, is to reorganize and reincorporate the company, issuing new bonds for those outstanding, the interest on the new bonds being guaranteed by the Southern Pacific Co. The new company is to be organized with a capital stock of $10,000,000. Under the terms of the sale $100,000 had to be paid in cash and deposited with the Register of the Court.

Illinois Central.—On the 7th inst., at Jackson, Miss., in the Chancery Court, a decree was rendered against the Yazoo & Mississippi Valley (controlled by this company) in favor of the counties of Hinds, Holmes, Yazoo and Leflore, for about $51,000. This suit was brought under an act passed by the last legislature. Under the terms of this road's charter it is entitled to exemption from taxation for 20 years from date of completion to the Mississippi River, and the act referred to takes the ground that it is not entitled to any exemption until the Mississipi River is reached. The road claims it is entitled to some exemption from commencement of work, in 1882, for the period of 25 years, the 5 extra years being allowed for the building of the road. Work on the road has been stopped, but its ultimate terminus is some point on the Mississippi River. The case was appealed.

This road has just completed a new depot at Jackson, Miss., at a cost of $40,000.

Kansas City, Arkansas & New Orleans.—Proposals are asked until Sept. 20 for the grading, masonry and wooden bridges of the Arkansas Division, from Beebe, Ark., to Monroe, La., 200 miles, and the Pine Bluff branch, 53 miles. Specifications can be seen at the President's office, in Chicago, Room 418, Rookery Building. The Arkansas Division crosses the Memphis & Little Rock near Carlisle, Ark., the St Louis, Arkansas & Texas at Stuttgart, and the Little Rock, Mississippi River & Texas at Monticello, Ark. Local aid has been granted to the extent of $800,000.

Kansas City, El Paso & Mexican.—Construction work has begun on this road north of El Paso, Tex. Citizens of El Paso had subscribed $100,000 to the road on condition that 10 miles of road are completed by Oct. 26; difficulties connected with the acquirement of right of way hindered operations and it is said that the time limit has been extended to Dec. 1.

Kansas City, Wyandotte & Northwestern.—The locating survey for the extension from Seneca, Kan., the present northern terminus, to the Nebraska line, 14 miles, is now in progress, and construction will soon begin. This company has surveyed for an extension from Leavenworth to Fort Leavenworth, Kan., 2½ miles.

Knoxville Southern.—It is rumored that the southern terminus of this new road, which is now under construction from Knoxville, Tenn., southward, will be at Murphy, N. C., the present northern terminus of the Marietta & North Georgia, instead of Blue Ridge, which is about 20 miles further south on the latter road. Messrs. Bergen & McFarland have completed 12 miles of the grading on their contract.

Little Falls, Van Hornesville & Otsego Lake Narrow Gauge.—A company has been incorporated and surveys are being made for a road from Little Falls, N. Y., south to Cooperstown. The length of the road will be about 17½ miles and the capital stock $160,000. The new line will run to the east of Richfield Springs, and an effort will be made to have the Delaware, Lackawanna & Western extend its Richfield Springs branch to connect with the new road.

Lehigh & Hudson.—The control of this road has passed into the hands of the Jersey Central interest by the purchase of a majority of the stock.

Lehigh Valley.—A survey is being made for a branch to Tamaqua, Pa. The line leaves the main line at New Boston, which is about 13 miles west of Tamaqua.

Los Angeles & Pacific.—Articles of incorporation have been filed at Los Angeles, Cal. The road is to be standard gauge and to extend from a point in Los Angeles on the Los Angeles County road, to Pasadena, 9 miles. The articles of incorporation also include a line to the Pacific Ocean, at or near Hueneme, in Ventura County, a distance of 60 miles. The capital stock is $1,800,000.

Manitoba & Northwestern.—Track on this road is now laid to Saltcoats, N. W. T., 26 miles beyond Langenburg, and 206 miles from Portage-la-Prairie. D. D. Mann, of Winnipeg, is the contractor.

Mansfield, Coldwater & North Michigan.—Judge Jackson, of the United States Circuit Court, filed his opinion at Cleveland, Sept. 5, on a point recently raised in the suit brought by ex-Governor Charles Foster, on behalf of the stockholders of this road, to vacate a decree made in 1877, whereby the road, between Mansfield and Toledo, was sold. Ex-Governor Foster and his colleagues charged fraud. A demurrer, based on technical grounds, was filed and argued, and this Judge Jackson sustains and dismisses the bill of complaints.

Meigs Elevated (Boston).—There has been some modification of the first proposed route from Bowdoin Square to Cambridge. From the Boston terminus the line will probably be through Green street, crossing what are now private estates to Chambers street, crossing that street to Allen or Poplar; thence over the Charles River embankment to an independent bridge to the flats between East Cambridge and Cambridgeport. The Cambridge terminus will probably be in Brattle square, near the University Press, in close proximity to vacant land that can be utilized for terminal purposes. The subscriptions for stock were opened in Boston last week, and of the $200,000 offered $70,000 was taken in an hour.

Memphis, Little Rock & Indian Territory.—The right of way is nearly all obtained, and construction will soon be begun.

Meriden, Waterbury & Connecticut River.—Surveys are being made for a branch from South Meriden, through Yalesville and Wallingford, to tidewater at or near New Haven. The R. Wallace & Sons Manufacturing Company, of Wallingford and Meriden, and capitalists who are interested in the company, are said to be back of the enterprise. Wallingford has large manufacturers but is served only by one railroad, the New York, New Haven & Hartford.

Michigan Central.—This road has lately built about 25 miles of branches, including the four miles of belt road in Detroit, previously noted. The branch to Edy's Mill, near Oil Springs, Ont., is 2½ miles long, and that to the Chautauqua Grounds at Niagara is 1 mile. The other branches are into pine timber lands.

Missisquoi Valley.—The Central Vermont has leased this road, upon a basis of 4 per cent. per annum upon its capital stock of $500,000. The line is from St. Albans, Vt., eastward to Richford, and has been in Central Vermont hands before, having been operated by the company or the receivers from 1873 to 1877.

Missouri Pacific.—The Kansas & Arkansas Valley road has been opened for business. This line connects Van Buren, Ark., with Wagoner, I. T., and forms direct connection between the Missouri, Kansas & Texas and the Little Rock & Fort Smith. The following are the stations: Van Buren Junction, Ark.: Muldrow, Sallisaw, Vian, Illinois, Braggs, Fort Gibson, Wagoner.

A dispatch from Lincoln, Neb., says: The Missouri Pacific has filed articles of incorporation and consolidation covering its lines in Nebraska. This action is taken to comply with the constitutional requirement that prohibits a foreign corporation from exercising the right of eminent domain in the state without first complying with the state law. The recent decision of the courts that has prohibited the road from condemning and acquiring title to right of way has led in part to this action of the road, and the Attorney-General of the state has also given notice that if foreign corporations do not incorporate they will be forced to do so by process of law, or else forfeit the rights of way that they were occupying.

Monterey & Gulf.—The contract for grading the first 40 miles of this road, which is projected from Monterey, Mex., southward to Tampico, on the Gulf of Mexico, midway between the Texas line and Vera Cruz, has been let to Sullivan Brothers. Gen. Trevino is General Manager. Instead of being a narrow gauge, as was first intended, it is standard, and will receive a subsidy from the Mexican Government of $8,000 per kilometre. It will be 419 kilometres (325 miles) long. It passes through one of the richest agricultural regions of Mexico.

New Roads.—A company has been organized to build a road from Marysville west to Colusa, Cal., a distance of about 30 miles. The projectors are Alex. Badlam, John L. Boone, W. C. Lynde, W. H. Ward, W. H. L. Barnes, W. N. Letcher and W. H. Thompson. The capital stock is $600,000. The bridge of the Southern Pacific will be used between Marysville and Yuba City.

Application has been filed in Quebec for an act of incorporation for a road from the Quebec Central starting from some point between Disraeli and Black Lake, and extending southeast to Lambton, about 15 miles.

A survey is being made for a road from the Ohio River at Wellsville, Ohio, following Yellow Creek to the Berghabe coal regions.

Northern Pacific.—The company has purchased the entire system of the Cœur d'Alene Railway & Navigation Company. It comprises a number of steamers that ply upon

Lake Cœur d'Alene and the Cœur d'Alene River, and 33 miles of narrow-gauge railroad extending from Cœur d'Alene Mission, Idaho, through the famous mining region of the same name. It is said that the Northern Pacific people will soon change the railroad to standard gauge.

Omaha, Dodge City & Southern.—Construction work is now progressing on this road from Superior, Neb., to Dodge City, Kan., and from the latter place to Trinidad, Col. Tracklaying will soon be completed from Dodge City to Montezuma, Kan.

Oregon Pacific.—Contracts have been let on about fifty miles from the present end of the track, which is 23 miles east of Albany. The condition of all the contracts is that the work is to be finished ready for track before the winter closes in. Between 500 and 600 men have already begun work. This season's work is expected to take the road through the heavy work on the North Santiam River, and up to and beyond the 400 ft. tunnel, which is the most serious obstruction between the end of track and the top of the Cascades. The company is laying the track. The rails are English steel, weighing 56 lbs. to the yard.

Pittsburgh, Cincinnati & St. Louis.—The third division of the Chicago, St. Louis & Pittsburgh, extending from Anoka, Ind., five miles east of Logansport, southeast to Richmond, 102 miles, has been joined with the lately acquired Cincinnati, Richmond & Chicago road extending from Richmond, southward, to Red Bank, O., seven miles east of Cincinnati, to make a new division of the Pan-handle system. The whole division comprises 171 miles.

St. Cloud Sugar Belt.—Projected to extend from Kissimmee, Fla., via St. Cloud to Runnymede, a distance of 12 miles. The grading is finished and tracklaying has begun.

St. Paul, Minneapolis & Manitoba.—Citizens of Ortonville, Minn., are offering inducements to the company to build a branch from Bellingham to that place, a distance of 14 miles. There are valuable granite quarries there.

San Antonio & Aransas Pass.—Work has begun on the branch which is to extend from Shiner northwest to Gonzales, Tex., about 8 miles. One hundred teams are at work, and the grading will be finished about Oct. 1. It is expected to finish the road to Luting, on the Southern Pacific, by Oct. 15.

South Atlantic & Ohio.—This road, extending from Bristol, Tenn., northwestward 40 miles to Speer's Ferry, Va., is to be extended to Big Stone Gap, 27 miles. The line is through a mountainous country. It is reported that bids are to be asked at once for the grading. W. F. Gordon, Jr., Bristol, Tenn., is chief engineer.

Tavares, Apopka & Gulf.—This Florida road is now n operation to Clermont, 19 miles from Tavares.

Temiscouata.—This Canadian road, extending from the northern terminus of the New Brunswick road at Edmundston, N. B., northwest to Riviere du Loup, on the St. Lawrence River, where it connects with the Intercolonial road, will be opened for traffic next week.

Texas Trunk.—It is given out that $1,000,000 worth of bonds have been placed, and that the work of repairing and extending the road will begin in a few weeks and be pushed to completion.

Toledo & Ohio Central.—Judge Jackson, in the United States Court, at Cleveland, Sept. 6, decided the claim of George J. McGourkey, of New York, as trustee, for $247,000 for the use of 17 locomotives, 3,000 coal-cars and 800 box-cars, used while the line was in the hands of a receiver, pending foreclosure proceedings. The question of remuneration was referred to A. J. Ricks, as special master, who allowed $80,000 of the claim. Judge Jackson now holds that the leased cars claimed by McGourkey, for the syndicate which he represents, were in fact paid for by the railroad and passed to the mortgagee in the foreclosure proceedings. The court, therefore, holds that the title to the cars passed to the purchaser at foreclosure sale.

Toledo, St. Louis & Kansas City.—An additional 50 miles of the track was widened on Friday last from Eugene, Ind., to Charleston, Ill., making a total of 320 miles in all widened from Toledo.

Union Pacific.—Engineers are surveying a line from Fairplay, Col., to the Horseshoe mines, a distance of 11 miles, and bids are asked for the construction work.

Vaca Valley & Clear Lake.—It is reported that contracts have been signed for 3,000 Chinese laborers to be employed in the extension of the road from the head of Capay Valley northwest about 25 miles into Lake County.

Vincennes, Oakland City & Owensboro.—President J. C. Rudd, of Owensboro, Ky., has called for bids for the construction of this road. The line is from Vincennes, Ind., southward through Oakland City to the Ohio River opposite Owensboro, Ky., about 90 miles.

Wabash.—On application of the dissenting first-mortgage bondholders for the appointment of Gen. McNulta as separate Receiver of the property embraced by the first-mortgage of the Toledo & Illinois Railroad of 1853, Judge Jackson, in the United States Court at Nashville, Tenn., has ordered Receiver McNulta to keep separate accounts and hold separate the earnings of the Toledo & Illinois. Further hearing of the motion for a separate Receiver will be held Oct. 22. Judge Jackson declared the first-mortgage bondholders entitled to secure all the earnings by a specific lien, and intimated that upon further hearing he would secure such a result by the appointment of a separate Receiver if necessary. The complainants have no fault to find with Receiver McNulta, but their grievance is that the surplus earnings are not equitably applied for the payment of interest, and that too much money is being expended in repairs under the order of Judge Gresham. In other words, they want all the net receipts applied to the payment of interest. The net earnings of the Hannibal & Naples and Chicago Divisions, with the extensive repairs that have been made, have not been sufficient to pay interest on those divisions. All the other divisions have earned a large surplus. This has caused a controversy over the method of book-keeping or allowance of earnings to the Hannibal & Naples and Chicago Divisions, adopted originally by Receivers Humphreys and Tutt and continued by Receivers Cooley and McNulta, and which divides earnings on a mileage basis.

Wabash Western.—The engineers of this road have made a preliminary survey for a line from Lexington Junction, Mo., through Richmond and Excelsior Springs to St. Joseph.

Western & Atlantic.—The state of Georgia, which owns this road, will probably take action concerning it at the next session of the Legislature, as the 20-year lease of it to Gov. Brown and associates expires Oct. 24, 1890. It is said that the Central of Georgia will offer to lease the road at $40,000 per month, and also that the Louisville & Nashville intends to offer $50,000 per month for a 99-year lease. The latter amount is just twice the present rental. It will be remembered that the lessees presented to the state last year a claim for a large sum expended for betterments to the property.

Western Counties (Nova Scotia).—The Canadian Minister of Railways has under consideration the question of going on with the construction of the proposed extension of this road to connect with the Windsor & Annapolis at Annapolis. A subsidy was voted at the last session of Parliament, but the road failed to sell sufficient bonds in London to go on with the work and therefore has done nothing. There is now a movement to have the government proceed with the building of the line and retain the ownership of it.

TRAFFIC AND EARNINGS.

Traffic Notes.

Iowa shippers who filed with the Railroad Commissioners complaints against the railroads have agreed to suspend the hearing of their cases pending the revision of Iowa rates, which shall remove causes of complaint.

Excursion tickets to the Grand Army encampment at Columbus, O., are producing demoralization in passenger rates on some of the principal lines in the Central Traffic Association. The Kankakee line has made a rate of 1 cent per mile, short line mileage, between Chicago and Columbus, with the privilege of stopping over at Cincinnati to attend the exposition there. This means a round trip rate of $6.25. Tickets are good 30 days, and therefore affect Cincinnati rates, the regular round trip rate between Chicago and Cincinnati being $12.

Grain rates from Chicago to Cleveland and Ohio interior points will probably not be advanced Sept. 15, as was agreed last week. When the question came to a final decision the Baltimore & Ohio was not prepared to vote. It asked for time to consider further.

The trunk lines have promulgated an emigrant tariff, showing through rates from New York to Kansas City $11.25, Council Bluffs $13.50, and St. Paul at $10. These are the net rates which the Western roads have refused to join in. It is surmised that the trunk lines accept $1 on through business beyond Chicago, but charge $5 to Chicago proper.

The Chicago-St. Louis Traffic Association has adjusted rates at all junction points in Illinois. All the rates will be advanced Sept. 17 so as to conform with the advance that affects business to all East Mississippi River points. The new rates, Chicago to East St. Louis, will be as follows:

1.	2.	3.	4.	5.	A.	B.	C.	D.	E.
47	38	29	20	15	15	14	12	11	9

The present rates are on the basis of 38 cents first class.

The International Association.

This new organization, successor of the Texas Traffic Association, is composed of the following roads:

Atchison, Topeka & Santa Fe, Denver, Texas & Fort Worth, Gulf, Colorado & Santa Fe, Houston, East & West Texas, Houston & Texas Central, International & Great Northern, Kansas City, Springfield & Memphis, Memphis & Little Rock, Missouri Pacific, Mexican Central, Mexican International, St. Louis, Arkansas & Texas, St. Louis, Iron Mountain & Southern, St. Louis & San Francisco, Southern Pacific (Atlantic System), Southern Pacific (Pacific System), San Antonio & Aransas Pass, Texas & Pacific, Texas Central. The headquarters of the association will be at Houston and Maj. J. Waldo continues Commissioner.

The Abused Shipper.

The monthly report of the Indianapolis Weighing Association, shows that in the month of August the following gains over shippers' weights were made: In car-load freights, 7,625,723 lbs.; in platform freights, 820,410 lbs., making a total gain over shippers' weights of 8,446,133 lbs.

Northwestern Rates.

Every one of the roads between Chicago and St. Paul has now reduced rates from Chicago to St. Paul to the basis of 40 cents first class. The Chicago, St. Paul, Minneapolis & Omaha is the last line to reduce. In giving notice of the reduction it says it will observe in all cases the fourth section of the Inter-state Commerce law. The Chicago & Northwestern as well as this road having decided to conform to the fourth section of the law and make rates to intermediate points no higher than the through rates, those roads which are yet basing intermediate rates on a 60-cent tariff will be compelled to reduce rates at all intermediate points where they come in competition with the northwestern line.

The Chicago, Milwaukee & St. Paul has also put into effect the rates between Chicago and St. Paul, established by the Burlington & Northern on traffic originating at or east of the western termini of the trunk lines. These rates are 31, 22, 23, 17, 11, and 9 cents.

Southwestern Rates.

Cutting of freight rates continues to a considerable extent, notwithstanding the general feeling that a general increase of business will soon remove all temptation to make reductions. Rates on lumber (by the Alton) and on hogs (by the Burlington) have been reduced in retaliation for previous cuts on cattle rates. The following Chicago dispatch, of Wednesday, however, indicates some progress:

"The general managers of the Western roads to-day succeeded in reorganizing the Western, Northwestern and Southwestern roads under the general name of the Western Freight Association. One form of agreement applies to the whole of this territory, but the association was divided into three sections, J. W. Midgely being elected Chairman of the Southwestern division and J. N. Faithorn Chairman of the Western and Northwestern. On all matters affecting two or more of the divisions the two chairmen are to act jointly, and they are also to exercise joint supervision over Colorado, Utah and Pacific Coast business. The Southwestern Association is strengthened by the addition of three new lines—the Chicago, Santa Fe & California; the Chicago, Milwaukee & St. Paul, and the Kansas City, Fort Scott & Memphis. The first action of the Southwestern lines after organizing was to agree upon a restoration of all rates, to take effect Sept. 23. The Western and Northwestern lines will meet tomorrow to canvass rates."

East-bound Freight Shipments.

The shipments of east-bound freight from Chicago by all lines, for the week ending Saturday, Sept. 8, amounted to 47,646 tons, against 43,825 tons during the preceding week, an increase of 3,821 tons, and against 45,150 tons during the corresponding week of 1887. The proportions were:

	Per cent.
Wabash	9.2
Michigan Central	8.0
Lake Shore & M. S	15.3
Pitts., Ft. Wayne & Chic	13.7
Chicago, St. L. & P	16.7
Baltimore & Ohio	6.4
Chicago & Grand Trunk	13.8
N. Y., C. & St. L	5.9
Chicago & Atlantic	11.0
Total	100.0

Of the above shipments, 2,481 tons were flour, 12,278 tons grain, 4,592 tons cured meats, 2,836 tons lard, 7,969 tons dressed meats, 1,369 tons butter, 1,639 tons hides, 578 tons wool, and 3,606 tons lumber.

Cotton.

The cotton movement for the week ending Sept. 7 is reported as follows, in bales:

Interior markets:	1888.	1887.	Inc. or Dec.	P. c.
Receipts	17,338	47,139	D. 29,801	63.2
Shipments	15,882	36,178	D. 20,296	58.3
Stock	17,828	34,754	D. 16,926	48.6
Seaports:				
Receipts	39,164	85,437	D. 46,273	54.1
Exports	18,015	22,880	D. 4,865	21.2
Stock	184,748	129,049	I. 55,699	43.1

Coal.

The coal tonnages for the week ending Sept. 8 are reported as follows:

	1888.	1887.	Increase.	P. c.
Anthracite	881,802	728,427	153,375	21 0
Bituminous	336,284	298,530	30,754	10.3

The Cumberland coal trade for the week ending Sept. 1 amounted to 76,776 tons and for the year to that date 2,341,339 tons.

Railroad Earnings.

Early reports of monthly earnings are usually estimated in part, and are subject to correction by later statements.

Following is the statement of the Northern Pacific:

	1888.	1887.	Inc.	P. c.
Miles	3,277	2,893	384	13.7
Gross earnings	$1,653,195	$1,299,586	$353,609	27.2

Following is the statement of the Atchison, Topeka & Santa Fe (including the Southern Kansas) for July, and for the seven months to July 31:

Month of July:	1888.	1887.	Inc. or Dec.	P. c.
Miles	3,023	2,611	I. 412	15.8
Gross earnings	$1,333,826	$1,534,902	D. $201,075	13.1
Oper. expenses (exclusive of taxes)	865,064	862,005	I. 3,059	0.3
Net earnings	$468,762	$672,897	D. $204,135	30.3
Seven months—Jan. 1 to July 31:				
Miles	3,017	2,484	I. 533	22.2
Gross earnings	$8,508,398	10,626,537	D. 2,118,139	19.9
Oper. expenses (exclusive of taxes	6,039,872	5,753,674	I. 286,198	4.9
Net earnings	$2,468,526	$4,872,862	D. $2,404,337	49.3

Earnings of railroad lines for various periods are reported as follows:

Month of July:	1888.	1887.	Inc. or Dec.	P. c.
Carolina Central.	$33,911	$28,866	I. $5,045	17.4
Net	18,576	def. 459	I. 19,035	
Chi., B. & Q	1,863,501	2,167,802	D. 304,301	14.3
Net	353,307	970,474	D. 617,167	63.5
Flint & P. M	195,659	223,163	D. 27,504	12.3
Net	71,385	73,244	D. 1,859	2.5
L., N. O. & Tex	151,161	115,285	I. 35,876	32.8
Net	27,507	17,311	I. 10,196	58.3
Northern Pacific.	1,603,585	1,202,576	I. 401,009	33 3
Net	666,183	545,718	I. 120,465	22.0
Ohio & Miss	275,591	322,692	D. 47,101	14.5
Net	55,917	100,804	D. 44,887	44.5
Ohio River	41,354	37,269	I. 4,085	10.6
Net	16,872	20,691	D. 3,819	18.4
Petersburg	36,339	36,402	D. 63	
Net	12,523	8,793	I. 3,730	42.3
Pitts. & Western.	181,092	164,688	I. 16,404	9.9
Net	22,900	44,982	D. 22,082	49 0
Rich. & Petersb	23,687	18,666	I. 5,021	26.8
Net	9,641	6,123	I. 3,518	57.6
Sea. & Roanoke.	38,215	32,218	I. 5,997	18.6
Net	7,483	5,132	I. 2,351	46.0
Total (gross)	$4 444,095	$4,349,627	I. $94,468	2.1
Total (net)	1,262,294	1,792,813	D. 530,519	29.5
Month of August:				
Alton & T. H	77,990	84,700	D. 6,710	7.9
Atlantic & Pac	245,622	186,120	I. 59,502	32.1
Cairo, Vin. & Chi.	75,745	78,322	D. 2,577	3.2
California South.	97,014	116,684	D. 19,670	16.8
Can. Pac	1,178,000	1,027,000	I. 151,000	14.7
Chi. & Ind. Coal	47,888	39,691	I. 8,197	20.6
Chi. & W. M	129,498	128,313	I. 1,185	0.9
Chi. & Atlantic	189 208	194,191	D. 4,983	2.5
Chi. & East. Ill	205,485	183,977	I. 21,508	11.6
Cin., W. & Balt	195,302	208,648	D. 13,336	6.3
Col. & Cin. Mid	37,323	34,923	I. 2,400	6.9
Det., Lan. & No.	103,933	106,420	D. 2,487	2.3
Evans. & Ind	28,429	27,157	I. 1,272	4.6
Ev. & Terre H	96,602	85,861	I. 10,741	12.5
Fitchburg	531,365	486,023	I. 45,342	9.3
Hocking Val	296,000	240,000	I. 56,000	23.3
Houston & T.	220,002	232,177	D. 12,175	5.2
Lake E. & W	233,171	208,755	I. 24,416	11.6
L., N. O. & Tex	187,949	182,490	I. 5,459	2.9
Louis., N. A. & C.	213,102	207,390	I. 5,712	2.7
Louisv. & Nash	1,340,345	1,369,562	D. 29,217	2.1
Manitoba	790,000	685,000	I. 105,000	15.3
Mem. & Charles.	119,953	139,086	D. 19,133	13.7
Mexican Central.	435,967	378,420	I. 57,547	15.2
Mobile & Ohio.	188,774	199,349	D. 10,575	5.3
N. Y. C. & H. R and Leased L	3,273,771	3,332,321	D. 58,550	1.7
N. Y., Ont. & W	193,131	170,252	I. 22,879	13.4
N. Y. & Northern	57,184	54,608	I. 2,576	4.7
Northern Pacific.	1,253,105	1,299,586	I. 353,519	27.2
Ohio R. & Ken	17,623	10,075	I. 7,548	74.7
Ohio & Miss	374,247	409,911	D. 35,664	8.7
Ohio Southern	51,398	47,201	I. 4,197	8.8
Pitts. & West	190,586	186,437	I. 4,149	2.2
Peoria, Dec. & E.	72,085	80,036	D. 7,951	9.9
Rich. & Danville	743,525	703,200	I. 40,325	5.7
St. L., Ark. & T	267,270	221,008	I. 46 262	20.9
Tol. & Ohio Cen	102,250	93,710	I. 8,540	9.1
Texas & Pacific	510,864	478,822	I. 32,042	7.1
Wabash W	566,667	652,205	D. 85,538	13.1
Wheeling & L. E.	72,344	65,515	I. 6,829	10.2
Wisconsin Cent	383,553	358,574	I. 24,979	6.9
Total	$15,794,270	$14,993,710	I. $800,560	5 3

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